ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LVII, No. 5. CHICAGO, SATURDAY, JULY 30, 1910. ISSUED WEEKLY.

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY
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PUBLICATION OFFICE: MARQUETTE BUILDING, CHICAGO

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
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SUBSCRIPTIONS.

One Year, United States	$3.00
One Year, Canada	4.00
One Year, Foreign Countries	6.00
Single Copy, 10 cents. Back numbers, beyond one month, each	.25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS 205
Electric Automobile Tests 208
Telephone Companies Merge 208
Cheaper Cable Tolls in Sight 208
International Congress of Medical Electricity 208
International Exposition of the Application of Electrical Energy in Railroad Service 208
Industrial Exposition in China 208
Public Service Commission Examination 208
Telephone Extension in Spokane 208
Electric Traction Opportunity 208
Angus S. Hibbard 209
Wireless in Venezuela 209
Electrical Engineering Graduates in 1910 210
Hydroelectric Power as Applied to Irrigation.—I. 211
Commission News from New York 215
Railway Signal Association 215
The National Electrical Contractors' Association 216
Limitations of the Weston Cell 217
No Receiver for United Wireless Company 217
New Western Union Division 217
Arrangements for Electric Club Picnic 218
Old Company Dissolved 218
Midsummer Meeting of National Electrical Jobbers' Association 218
International Municipal Congress and Exhibition 219
Electrical Medical Apparatus in Demand in Europe 219
Ohio Electric Light Association 220
Peat as Fuel 220
Westinghouse Annual Meeting 220
Norwegian Experiments in Electric Smelting 221
Electric Line in Liége, Belgium 221
Index of Refraction for Electric Waves 221
Large British Exhibit for Turin Exposition 221
British Imports and Exports 221
Resistivity of Alloys 221
Examination for Steam Engineer 221
The Grounding of Secondaries 222
Presents Testing Plant to University of Illinois 223
Alternating-Current Industrial Power-Plant Switchboards 224
The Choice of a Prime Mover 226
Waterpower Development in Sweden 226
Novel Lighting Effect at the Brussels Exposition 227
The Illumination of Interiors 227
Testing the Steadiness of Sources of Light 228
Factory Lighting 229
The Telephone Ouster Suit in Kansas 230
Time Signals by Wireless Telegraphy 230
Depreciation of Telephone Equipment 230
The History of the Telephone 231
The Influence of High-Tension Currents on Telegraph and Telephone Installations 233
The Action of the X-Ray in Large and Small Doses 234
Theater Engineering in Canada 234
A New Form of Motor 234
A New Method of Coaling Vessels 235
Inspection and Testing of Materials 235
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 237
NEW ELECTRICAL AND MECHANICAL APPARATUS AND APPLIANCES 238
CURRENT ELECTRICAL NEWS 243
RECORD OF ELECTRICAL PATENTS 248

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ECONOMY IN PIONEER WORK.

One of the most important problems of an engineer in developing nature's resources is the necessity for practicing economy, and especially is this true when he is engaged in any kind of pioneer work in which an adequate return for invested capital is not at the outset practically assured. Many a project has gone into the hands of a receiver on account of a too lavish initial outlay when perhaps a less substantial installation would have sufficed equally as well and have cost much less to build and probably less for upkeep and running expenses.

Of course there is the danger of going to the opposite extreme and installing a plant which will prove inadequate to its demands within a comparatively short time. Instances of this are numerous, there being plenty of central stations which contain several small and therefore inefficient prime movers, added one by one to keep up with an increasing load, where by a little forethought a single large efficient unit might have been installed in the first place. Such a unit would not at first run at its maximum efficiency on account of being underloaded, and furthermore there would be a greater capital cost involved over that of a smaller machine; but later, when the station load improved, the extra economy of running would more than pay for these in the long run.

On other pages of this issue there appears the first part of an abstract of an excellent paper entitled "Hydroelectric Power as Applied to Irrigation," in which the author, Mr. John Coffee Hays, gives some thoughtful views on the subject of economy in pioneer work. Dealing with the kind of installation denoted by the title of the paper, Mr. Hays states that while the generating stations at the outset should be of a fairly permanent nature, the distributing system should be light and in many cases even of a temporary nature. This he urges on the score of economy so that rates for current supply may be made as low as possible in order to develop a market for power. In this manner the rates may remain practically permanent during and after development, and surpluses may later be used for installing a more permanent system. Even with the generating stations may this policy be pursued to a certain extent. Thus the author advocates the wooden flume for pioneer work, instead of the tunnel, wooden poles instead of steel

towers, the use of an auxiliary steam plant to help out in times of accident or peak load, and other more or less temporary expedients.

There is reason in all of this, and when engineers begin to look more to the business end of a proposition, there will be less wildcat exploitation such as has brought many hydroelectric schemes into disrepute.

THE ELECTRIC MOTOR IN THE ROLLING MILL.

The driving of rolls in the rolling mills presents the most severe conditions, probably, to which the electric motor has ever been subjected. The load is thrown on very suddenly and it has been estimated that in certain cases the change from no load to full load occurs within a single revolution of the motor. Railway service has usually been considered hard service, but rolling-mill service is even more severe in load conditions, although the speed variations are more definite.

With the introduction of the electric drive in rolling-mills, more has been demanded of the motor than was required of the direct-connected steam engine. The motor is not only replacing the steam engine in this field, but it is doing more and doing it better.

In applying the motor to this use, the addition of a flywheel to the motor shaft, to increase the inertia of the rotor, is a practical necessity, and greatly simplifies the electrical problem. This flywheel not only permits the use of a motor of smaller capacity than would otherwise be required, but it also improves the load factor of the generator supplying current and permits of better regulation on the supply circuit. The problem of flywheel interaction has been worked out by Mr. F. G. Gasche in a recent paper presented to the American Institute of Electrical Engineers.

A similar application of the flywheel should be advantageous in many other cases of motor drive with a rapidly varying load, and its use will also in many cases render superfluous a storage battery, floating on the mains, which might otherwise be necessary to relieve the generator of sudden shocks.

ELECTRICAL ENGINEERING GRADUATES.

A steady increase in the attendance at the technical schools and colleges of the country has been noticeable each year for some time past, and constitutes good evidence that engineering activities are constantly enlarging.

While all the students who are graduated each year from engineering courses do not follow that profession, by far the larger portion do become engineers, and an even larger number do make a start in some engineering work, even though they may later drift into some other field of endeavor.

In order to determine the branches of electrical work which attract the greater numbers of graduates from courses in electrical engineering, the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN has collected statistics regarding the students graduated in 1910, and presents these upon another page of this issue.

While the figures presented make no claim to being a complete record of the year's graduates, they are useful in showing the proportionate distribution of the men among the various electrical industries. The fact is prominently brought out that nearly one-half of the graduates enter the apprentice courses in the works of the large manufacturing plants, although in some quarters this apprenticeship work is not so popular as when it was started a number of years ago.

This condition makes it evident that the average graduate realizes that he is not a full-fledged engineer, and needs the varied contact with materials, men and conditions which can best be had by just such a round of experience.

The fact that only about ten per cent of the men lack positions at the time of graduation, some of them from choice, shows that there is a wide-spread and steady demand for the technical graduate in engineering work and that the student does not lack opportunities after finishing his course. If, after getting a start, the graduate fails of advancement, it is more than likely to be due to failure on his own part to apply energy, brains and common sense in seeing how much service he can render to his employer.

SOME CONSIDERATIONS RELATIVE TO ORNAMENTAL STREET LIGHTING.

There has been a decided movement in recent years for the ornamental lighting of business streets. This has received marked impetus in the last two years through the employment of tungsten-lamp clusters for this purpose. Merchants have long realized the immediate advertising value of brightly illuminated and attractive store windows for the display of their wares. Electric signs have been used extensively to draw attention to places of business and particular goods. But the most effective way to get people to the street at night is to make it, in the first place, safe to venture there and, in the second place, an inducement to promenade there. Both these aims are accomplished by a bright and attractive system of street lighting. It has been said that human beings are like moths in being drawn to a brilliant light. Particularly is this true when the light is of a pleasing kind.

The dual value of ornamental street lighting has not been recognized sufficiently. In rendering a street safe against danger from highwaymen, rowdies, etc., as well as from speeding automobiles and street cars, it has a distinct police value and is therefore performing a public service for which the community as a whole should pay. In making a street an attractive place to promenade and examine the store-window displays it has an undoubted advertising value of benefit to the merchants on the street, for which they should pay.

In practically all of the special street-lighting installations the merchants or property owners have paid for the major portion or even the entire cost of the installation. This has imposed a greater burden upon them than some were disposed to assume. As in many instances no regular assessment has been levied to pay for the improved lighting, no compulsion could be exercised and the matter had to be left entirely to the option of the merchants. The result has been that, in fairness to those who did contribute, the special lights were installed in front of the buildings of the contributors only. Therefore the lighting has been very irregular in many installations, gaps with no lights at all being found here and there and some merchants having more than one post per unit frontage. The effect has been far from satisfactory, the lack of uniformity largely defeating the attractiveness of the installation. While in one sense even a few scattered lights are better than none at all, in a broader sense the idea of providing an ornamental lighting requires that the esthetic features be given first consideration. Uniformity of spacing is certainly one of these.

To insure this the municipal authorities must be impressed with the importance of taking an active hand in such a project. Its police value has already been pointed out. There is no question that the public at large is benefited and should therefore contribute to the cost in proportion to that benefit. Where the property owners have paid for the original cost of the installation the city might justly be called upon to pay for its operation and maintenance. At any rate, half of the latter costs should be paid for by the city, as this probably represents the minimum public benefit from the improved lighting. When the city assumes its share of the cost, recognition of the public benefit is achieved and the right to assess the merchants on a uniform frontage basis for the remainder of the cost is established. The result is that neither the private nor the public burden is as great as when either interest must carry it alone and therefore a larger and more uniform installation can be carried out than would otherwise be possible.

When a special street-lighting scheme with public aid is contemplated the former inadequate system in use on the streets affected should be discarded. The appearance of a street with a multiplicity of designs of lamp-post is far from pleasing. It is quite easy to arrange for the lighting of certain units all night, the majority being cut out near midnight. It certainly is not desirable to maintain a separate set of arc lamps for all-night use just because they were already in place.

It is becoming quite common in special street-lighting installations to place the lamp-posts on the two sides of the street directly opposite each other. This makes a very pleasing effect where the spacing between adjacent posts on the same side of the street does not greatly exceed the width of the roadway; it also makes a simple problem of lamp location at street crossings. Where the spacing between adjacent lamps greatly exceeds the width of the roadway the mounting of lamps directly opposite each other results in uneven light distribution and therefore the staggered arrangement is preferable.

In some installations little attention has been given to the proper maintenance of the lamps and posts. This is particularly true of tungsten-lamp installations, where the globes have been allowed to get so dirty as to reduce the efficiency considerably and the ornate effect very decidedly. Frequent cleaning of glassware is imperative, as also the periodic painting of the standards, if these be of iron.

TRACTION ECONOMY.

It does not require very close observation of the average motorman of an electric car to discover that he has no idea of economy or efficiency in his application of electric power. Most of us must have been many times impressed with this fact, and must have wondered why the motormen are not properly instructed as to how to bring a car up to speed with the least waste of energy in the controller. And how often, when the car has been braked too soon, is a little more power applied with the brakes still on!

Proper acceleration has been secured by the use of automatic apparatus which controls the cutting out of resistance and leaves to the motorman only the closing and opening of the main switch. The use of such apparatus is, however, largely confined to elevated and interurban roads, and it is seldom, if ever, applied to the ordinary surface lines.

To secure the greatest economy of operation, it is necessary not only to accelerate at the highest rate which the capacity of the motor will permit, but also to waste as little power as possible in braking. This means that coasting should be resorted to as largely as possible, the brakes not being applied (when on level track) until the speed has been reduced much below normal. Rapid acceleration saves time which can be economically devoted to coasting and less abrupt stops; at the same time the wear on brake shoes and general cost of brake maintenance is very much reduced.

Recent tests on the elevated roads in New York and the subway in Philadelphia have demonstrated that a saving in power of from twenty-five to thirty-five per cent can be accomplished by judicious coasting. On the Second Avenue line in New York a check is kept on the motormen by the installation of coasting clocks which indicate what part of the total running time has been spent in coasting. This is hardly feasible or necessary on most surface lines, yet proper instructions to motormen, after proper training for the work, would undoubtedly result in an enormous saving of power. That such a saving is not only possible but feasible, is evident after the most cursory examination of the facts.

Electric Automobile Tests.

Tests were recently conducted at West Orange, N. J., to find the touring radius of the automobile driven by Edison storage batteries. Two cars left the laboratory and each car carried two passengers. One traveled to Manhattan, thence through Staten Island, by ferry across the Arthur Kill, and on through Perth Amboy, Metuchen, New Brunswick, Bound Brook, Dunellen, Plainfield, Westfield, Springfield, Union and Elizabethport. Returning to Staten Island the car crossed to Bergen Point and Bayonne, running along the Hudson Boulevard to the Mercer Street ferry at Jersey City.

The second automobile had a course laid out north of Elizabeth to Morristown and Little Falls, and from there by way of Montclair, Belleville, and Arlington to Jersey City.

"These tests," said Thomas A. Edison, "will demonstrate that a man can take his wife into the country and have no fear about getting back. On such roads as one will encounter from New York to Philadelphia a set of batteries ought to be good for 150 miles without recharging. On hilly roads the machines ought to run about 125 miles."

Telephone Companies Merge.

The Federal Telephone and Telegraph Company has certified to the Secretary of State that it has merged the following companies of which it owned all of the capital stock: Corning, Watkins, Ithaca, the Springville, the Marilla, Canisteo, Wellsville, Hornellsville Telephone Companies, Conewango Valley Home, Cohocton Valley Telephone and Telegraph Companies, Elma Telephone Exchange, Citizens' Telephone Company of Bath, N. Y.; Attica Home Telephone Company, Citizens' Telephone Company of Akron, N. Y., and the Valley Telephone Company. The certificate is signed by Bert G. Hubbell, president of Federal Telegraph and Telephone Company.

P. S. Commission vs. Union Railway.

The New York Public Service Commission, First District, has applied to Justice Bischoff of the Supreme Court to set aside the trial of the suit brought by the commission against Receiver Whitridge of the Union Railway Company to recover $800,000 for an alleged violation of an order of the commission directing the equipment of the cars of the company with a certain type of wheel guards. The order asking the company to make certain improvements in its rolling stock was issued by the commission on April 27, 1909. Justice Bischoff reserved decision on the application.

Cheaper Cable Tolls in Sight.

At the annual meeting of Marconi's Wireless Telegraph Company, which was held at London, England, early in the month an announcement was made that cheaper cable tolls were in sight. Although the fire which destroyed the Glace Bay station was a great misfortune it was not an unmixed evil and the improvements which will be made in reconstruction will be most valuable to the wireless service.

It is the intention of the company to put every British possession into wireless communication with every other one.

International Congress of Medical Electricity.

An international congress for the discussion of medical electrotechnology and radiology will be held at Barcelona, Spain, on September 13 to 18, 1910. The sessions will convene in the amphitheater. In connection with the congress there will be an exhibition of scientific and technical apparatus. The Spanish railroads have granted greatly reduced rates to all that expect to take part in this congress.

Electrify German Road.

The Bavarian Diet has voted $1,500,000, the first installment to be used for the construction of waterpower works at Lake Walchen, where power for the complete electrification of the state railroads of Bavaria will be developed. Further appropriations will be made annually.

International Exposition of the Applications of Electrical Energy in Railroad Service.

The Russian Royal Technical Society, of St. Petersburg, will soon hold in its building an international exposition of the manifold applications of electrical energy in railroad service. The idea is to demonstrate visually to the administrations of the Russian railroads the great progress that has been attained in electric railroading. It is planned to have the exposition in three divisions: (1) The use of electricity in the operation of steam railroads; (2) electric traction; (3) the utilization of hydroelectric power. The committee of organization of this exposition will be glad to furnish all the particulars upon addressing it at Panteleemonskays 2, St. Petersburg, Russia. The Russian railroads have consented to grant special low rates on exhibits for this exposition.

Industrial Exposition in China.

A copy of the regulations governing the storage of exhibits at the Nanking Industrial Exposition, now open in that Chinese city, has been forwarded by Vice-Consul A. W. Pontius, and will be loaned by the Bureau of Manufactures, Washington, D. C., to those interested.

Public Service Commission Examination.

An examination will be held on August 10 and 11, at the regular places, to fill vacancies occurring in the positions of aid and deck officer in the Coast and Geodetic Survey. Applicants should apply to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any place of examination. Request should be made for Form 1312.

Telephone Extension in Spokane.

Seven hundred thousand dollars will be expended by the Pacific Telephone and Telegraph Company in improving its system into Spokane, according to a statement by an official of the company, who also said that thirty per cent of that amount will be used in making changes in Spokane. Plans are under way for the construction of a larger central station and offices.

There are now more than 17,700 telephone instruments in operation in Spokane, and it is thought this number will be increased twenty per cent within the next six months.

Electric Traction Opportunity.

An American embassy in a foreign country has forwarded three copies of the conditions proposed by the Ministry of Public Works in regard to the construction of new electric street-car lines, which can be obtained by interested firms upon application to the Bureau of Manufactures, Washington, D. C., quoting File No. 5157.

Angus S. Hibbard.

That inventive ability is not synonymous with executive ability is a well-known fact. That the two are combined in some few individuals at least is the good fortune of society, for to this combination is due in a large measure the success with which important inventions are now rapidly made available for the public good. Among the men whose possession of these dual traits was highly instrumental in making the telephone an every-day utility in private and commercial service is A. S. Hibbard, who for seventeen years has been the general manager of the Chicago Telephone Company and for nearly thirty years prominently connected with telephone interests.

ANGUS S. HIBBARD,
General Manager of the Chicago Telephone Company.

Angus S. Hibbard was born in Milwaukee, on February 7, 1860, and secured his education in the Wisconsin metropolis, and at Racine College. After a siege of ill health he started his active career with one of the railroads entering Milwaukee. Within a year he entered the telegraph and telephone service as secretary to the superintendent of the Northwestern Telegraph Company. As the telephone had just come to public notice, Mr. Hibbard took up its study and soon became enthusiastic about its possibilities. At the age of twenty-one he became superintendent of the Wisconsin Telephone Company. Here his ability to invent and to carry out new ideas received its first impetus. He became convinced that speech transmission could be carried out to greater distances and his early experiments in long-distance work showed its commercial practicability and attracted attention from all parts of the world. Under his direction a number of toll lines were successfully extended from the Milwaukee exchange.

At about this time the American Telephone and Telegraph Company began its long-distance service and it was but natural that Mr. Hibbard should be chosen to become its first general superintendent. He entered this enlarged sphere of activity in 1886 at New York City. During the seven years that he was connected with this company great developments in the telephone service took place. He foresaw the need of eliminating disturbances by the use of complete metallic lines, and, against great odds, metallic circuits became quite generally used, largely through his influence. Long-distance lines were established between many points in the East and rapidly extended to Chicago. The successful installation, operation and maintenance of these long circuits with conditions not met before was due in no small measure to Mr. Hibbard's ability to devise new apparatus and methods to cope with the new problems presented.

During the World's Fair year, 1893, Mr. Hibbard was called to Chicago to take the position of general manager of the Chicago Telephone Company. This position he has held continuously ever since, subsequently being elected also to the position of vice-president of the company. During his long residence in Chicago there has been a stupendous advance in telephone service both in the city and its suburbs. Mr. Hibbard has constantly striven for improvement in the service and its extension to all parts of the metropolitan area. He is thoroughly intimate with all departments of the company's business, and there is not one whose efficiency has not been improved by the use of his methods. He is the inventor of a number of patented telephonic apparatus and methods, including selective signaling, distributing and protective devices, switchboard designs, operating features, test circuits and methods, etc.

Mr. Hibbard has found his greatest recreations from the cares of business in music, and outdoor sports. He has long been prominently identified with the Apollo Musical Club, one of the leading choral societies of the country. He is the composer of a number of excellent operettas and songs; at one time he was strongly urged to give up his business interests and devote himself to musical compositions. His most conspicuous work in this line was the writing for the Chicago Association of Commerce of a group of civic songs, which have come to be known as the "Songs of Chicago," and for several years have been sung by the Association in its many meetings, and in clubs, schools and other places. For physical recreation Mr. Hibbard has devoted himself to those sports which call for outdoor muscular exercise. In bicycling days he was one of the best amateur riders. He later became an enthusiastic devotee of golf and has outplayed many of his friends by his energy and skill. He is a member of the Glenview Golf, Union League and University Clubs. For nearly twenty years he has been a member of the American Institute of Electrical Engineers.

Wireless in Venezuela.

An effort is being made by a German agency, writes Consul Isaac A. Manning, to secure the introduction in La Guaira, Venezuela, of the Telefunken system of wireless telegraphy.

ELECTRICAL ENGINEERING GRADUATES IN 1910.

STATISTICS SHOWING THE FIELDS OF WORK UPON WHICH THEY ENTER.

In order to determine the paths along which the graduates of courses in electrical engineering in our colleges and technical schools enter into the practice of their profession, the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN has collected statistics regarding the students graduated in 1910. In years of commercial and engineering activity, like the present, nearly all of the graduates are slated for positions before commencement, and those who are not engaged by July 1 are usually so from choice.

Requests for information were sent to all professors in charge of electrical engineering courses who could be reached, and replies giving the desired information were received from thirty-eight institutions. While the institutions so responding represent only about half of the total number of those offering such courses, there is no reason to believe that the proportions would be changed if the omitted schools had been included. As the omitted institutions include several with large engineering courses, the total figures would, however, require to be considerably altered in order to represent a complete census of the country.

In grouping the occupations into which this year's graduates are entering, the apprentice courses of the large manufacturing companies have been separated from other positions in manufacturing establishments, as they are regarded as representing a different and particular class. It is to be noticed that this programme is chosen by forty-three per cent of the graduates as the most desirable sequel to their college course in the preparation for more important work as engineers. As ten per cent of the graduates were not yet placed in any positions, this represents nearly one-half of the total number already assigned.

The next greatest demand for graduates comes from the power-plants, central stations, etc. This group has been made to include a few who will be engaged on transmission-line work and other employment connected with power generation and transmission.

Twenty-two of the men will take up teaching and ten will pursue further courses of study, making a total of 5.7 per cent who will remain at the colleges.

Only five men are registered as engaging in work entirely foreign to electrical or other engineering. Eight others enter the commercial offices of electrical concerns. One of the men entering the army will engage in engineering, the other probably not. There is thus a total of fourteen men or 2.5 per cent who will not engage in technical work at the outset.

Next after the apprentice courses and central-station work, the telephone companies make the greatest demand for new men, and this work undoubtedly enlists today the services of a greater proportion of college-bred men than ever before.

The telegraph companies, on the other hand, call but few to their service, and no doubt recruit their ranks mostly from men who have not been technically educated. Many of their technical positions are filled by men who started in as operators and advanced to more responsible positions after learning the technique of the work by experience.

Electric railways also fail to draw men in proportion to their industrial importance.

The total number of graduates from the thirty-eight institutions represented is 565. The state universities turn out over forty-seven per cent of these men, or nearly half, whereas the state colleges and other technical schools com-

	TOTAL		GEOGRAPHICAL DISTRIBUTION.					CLASS OF INSTITUTION				
	Number	Per cent.	New England and Middle Atlantic	Southern	North Central	Rocky Mountain	Pacific	State Universities	Other Universities	Technical Schools	State Colleges	Other Colleges
Manufacturers' Apprentice courses	243	43.0	61	54	82	20	26	94	23	51	71	4
Manufacturers' Testing-room	7	1.2	7	..	..	..	..	..	..	..	..	..
Other Manufacturing	26	4.6	8	..	15	1	..	14	..	4	8	..
Central Stations, etc.	64	11.2	15	5	34	2	8	36	10	8	9	1
Consulting Engineers	15	2.7	2	..	11	..	2	10	4	1	..	..
Contracting and Construction	7	1.2	..	..	1	2	4	1	..	..	6	..
Telephone	34	6.0	13	2	8	3	8	16	7	5	6	..
Telegraph	4	0.7	1	..	1	..	2	2	1	..	1	..
Signaling	6	1.1	3	..	3	..	..	2	1	1	2	..
Electric Railways	13	2.3	8	..	3	..	2	5	2	4	..	2
Steam Railways, other than Signaling	4	0.7	2	..	1	..	1	1	1	1	..	1
Army	2	0.4	..	2	..	..	..	..	..	1	1	..
Commercial Office of Manufacturing or Operating Company	8	1.4	..	..	6	1	1	6	..	1	1	..
Other Electrical Occupations	5	0.9	1	..	2	1	1	3	1	..	1	..
Other Engineering Occupations (not Electrical)	2	0.4	1	..	1	..	..	..	1	1	..	..
Teachers	22	3.9	8	4	8	1	1	9	4	5	3	1
Graduate Study	10	1.8	1	6	3	..	..	4	3	1	1	1
Other Occupations (not Engineering nor Electrical)	5	0.9	2	2	..	1	..	1	1	1	1	1
Not Known	30	5.3	..	..	..	..	30	30	..	..	..	..
Not Decided	58	10.3	1	8	36	3	10	34	..	17	7	..
Total	565		134	85	215	35	96	268	66	102	118	11

bined furnish thirty-nine per cent. This is shown in the table by grouping the graduates according to the class of institution. It is to be noticed that most of the men taking graduate studies are from the universities. Most of the men going into the commercial organizations are also from the universities.

The geographical distribution is also shown in the table. This shows that the greatest proportion of students entering the apprentice courses come from the Southern States. The proportion is also high from the Rocky Mountain section. The smallest proportion of "not decided" is for the northeastern section of the country, which would indicate that the men in that section find their services in greater demand. This is only natural, since the manufacturing and operating establishments are more numerous in that region.

The largest proportion is for the North Central states, the others showing about the average value.

Hydroelectric Power as Applied to Irrigation.[1]—I.

Including an Illustrated Description of the System and Work of the Mt. Whitney Power Company.

BY JOHN COFFEE HAYS.[2]

Among the many uses to which hydroelectric power is being applied, that of electrically-pumped water for irrigation is being advocated at present in a great many instances; and while the mere pumping of the water is so simple as to be hardly worthy of discussion, it may be of interest to point out some of the operating conditions encountered in a project formed chiefly for this purpose.

A hydroelectric system to supply power for pumping water for irrigation will usually be required to build up its own market in the territory served, and it is manifestly necessary at the outset carefully to study the territory. Usually some pioneer work by progressive farmers will show what the land is capable of producing, but the greater part of the territory will consist of barren country planted to grain, or used for grazing purposes, with here and there a town. This land is in large holdings, and the first thing to be determined is the amount of subdivision which may be expected, and whether the proper men are in the field to bring this subdivision about. The character of the land is, of course, of primary importance and the percentage of good land should be carefully determined. Irrigated land should have a slight slope for distributing the water and must be reasonably smooth. Hardpan near the surface must be guarded against, as it generally denotes a rather poor quality of soil. The adaptability of the soil for different products, and the climate should be considered, yet data on these two points are hard to get and are usually unreliable. Tests and analysis of the soil would seem to be the natural way of determining its adaptability to the different products, but the agriculturist pays very little attention to these analyses, and has apparently a good reason for this, as they are often unreliable.

In the San Joaquin and Sacramento valleys it has been demonstrated that almost any kind of products may be raised on the good lands. Only a small portion of this land has been planted to citrus fruits, but small groves may be found along the entire length of the valley, and it would therefore seem as though it were all adapted to this class of products if water is applied. The best conditions seem to exist, however, where the mountains rise abrupt-

FIG. 1.—ORANGE GROVE NEAR EXETER.—WATER IS PUMPED TO HEIGHT OF 480 FEET BY ELECTRICITY.

1 Abstract of a paper presented at the Pacific Coast meeting of the American Institute of Electrical Engineers, May 6, 1910. The photographs are reproduced by the courtesy of the author.

2 President of the Mt. Whitney Power Company.

ly from the valley, and the level flat land extends up to the foothills, for, where a long stretch of rolling country lies between the plains and the hills, hardpan and bedrocks are generally very much in evidence.

Due to the fact that oranges in the San Joaquin valley ripen and are marketed a full month earlier than those

FIG. 2.—CONSTRUCTING TULE RIVER DITCH.

in the southern part of the state, they bring exceedingly good prices, and the growth of this industry is very rapid. The present citrus districts, as in fact is most of the land in the citrus belt, are above the existing irrigation canals, which in most instances divert all of the water available from the rivers, and are therefore entirely dependent on ground waters for irrigation; and, as the profits from this crop warrant a large expenditure, it is naturally the best market for power for pumping purposes. Aside from citrus fruits, all kinds of high-class products, such as deciduous fruits, berries, vegetables, nuts, vines, and alfalfa are to some extent also irrigated by pumped ground water.

The amount of water required for the irrigation of different products varies to such an extent in the different communities that it is impossible to get any figures which would be at all accurate. The character of the soil is accountable for the difference to a large extent, but the cost of water and the personal equation are accountable to a very much larger extent. There is usually a marked tendency to the over-use of water. The duty of irrigation water in California is believed to average about two feet in depth in addition to the average rainfall.

In the Imperial Valley, in 1906, 120,000 acres were irrigated and a total average depth of 2.04 feet was used, the main crop being grain. In San Diego County on land planted to citrus fruits an average depth of 1.5 feet was used from 1889 to 1899. Around Los Angeles it is estimated that an average depth of 2.4 feet is used.

In the Modesto and Tyrlock districts as much as eight feet to ten feet in depth was used at the start, but in 1908 the depth varied from 1.2 feet to 3.6 feet. In the Fresno district very little water is applied to the surface of the land at present, the land being subirrigated by seepage from the canals.

DEVELOPMENT OF SYSTEM.

In determining the policies and the scope of a proposed hydroelectric system for the supply of power for pumped irrigation, it is necessary to determine at the outset the exact territory to be served and the general policies to be followed as regards charges, contracts, extensions, etc., or, in other words, a definite goal must be set, the power company must do everything possible to assist development, and any inhabitant in any section of the territory must be supplied with power whenever it is required. Therefore, the power system simply grows up with the country, and while this growth is taking place (it of necessity must take many years), it must be considered that the

FIG. 3.—PENSTOCK RESERVOIR, TULE PLANT.

power system is in course of construction during the entire period. This is the main feature in which the power project depending entirely upon an irrigation market differs from the project supplying ordinary commercial business in an already well-settled community, and this is a difference which is seldom fully understood and the time element not fully provided for.

The initial installation will usually cover various towns and communities, and, if the territory is partially developed, the development will probably be close to the towns. The business

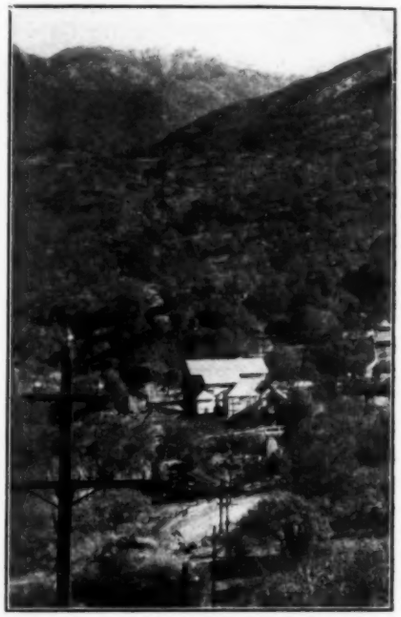


FIG. 4.—POWER HOUSE NO. 1.

available may, therefore, be fairly well concentrated at the start, and consequently profitable as far as it goes, but naturally only a small amount of the ultimate power required will be marketed. The extensions to the system will be made from these towns, and the fact that development of the community always starts near the town and grows outward is a most favorable condition of affairs for a power company. The price of land is always greatest near the towns, and decreases in proportions to the distance from any center, yet the land near the town is the first developed. These towns are built along the railroad, and being the shipping points, the reduced cost of hauling to the railroad to a certain extent offsets the additional cost of the land.

THE HYDROELECTRIC SYSTEM.

The character of construction of a system depends entirely on the class of market, and for irrigation a slight discontinuance of service is not serious, therefore a light construction is permissible. The generating stations at the outset should be of a fairly perma-

nent character, but the distributing system may and actually should be of a light and in many cases even bordering on a temporary character, as it is necessary to economize in every way at the outset to warrant the low rate which it is necessary to charge in order that the market may be developed; for it is necessary at the outset to establish a rate which will continue in effect when the system is fully developed. Even the expense of the generating stations may be reduced to a considerable extent at first, and as the system increases and the market becomes concentrated, improvements of a more permanent nature may be added.

FIG. 5.—DITCH AND FLUME LINE, TULE PLANT.

FIG. 6.—PUMPING STATION IN ORANGE GROVE.

Notwithstanding this, the writer has heard engineers of standing make the broad statement that there was no excuse for the use of a wooden flume and that a tunnel was the only proper thing; also that certain plants were altogether too flimsy and temporary in their design, and that the wooden pole line was entirely obsolete. When these statements are made, the writer cannot but think that the assertions are prompted by a lack of regard for the first principle of engineering, namely, economy. Every one who has had any experience with the wooden flume knows the many interruptions of service caused by it, yet, if constant service is not absolutely necessary, what possible type of construction can compare with the flume? It is short lived, but several can be built for the cost of a tunnel, and during the early life of a transmission system every dollar counts. If the system warrants a tunnel, it may be constructed during the life of the flume to take its place. Of course, if the systems depend entirely upon one power plant, the replacement of the flume is both difficult and expensive, but few existing systems of any importance rely entirely on one plant, and there is usually sufficient capacity available during certain periods of the year to allow for the shutdown of one station. Also an auxiliary steam plant is often cheaper than a tunnel and much more useful.

Wooden pole lines are also perfectly reliable in our California climate and are a very worthy substitute for the steel tower lines in respect to business development, and there is nothing to prevent the construction of the tower line when the wooden pole has outlived its usefulness; no interruption of service is necessary, as the right of way should be wide enough to accommodate both lines.

Among the different part of the system where considerable expense may be saved is the switching gear, which may be extremely simple at the outset and still ample. A small galvanized iron building on a wooden frame is a thoroughly satisfactory building for the pioneer substation, which can be replaced by a permanent and fireproof structure when the business warrants. By the construction of light, inexpensive tie lines one substation may be arranged temporarily to supply the territory of another, and by the construction of a ring system many miles of expensive transmission line may be replaced by a much lighter class of construction, which will answer all purposes for many years.

In the greater part of California the conditions are ideal for long pole spacing. High winds seldom occur and sleet is unheard of, but it is not uncommon to see a line consisting of three wires ranging in size from No. 2 to No. 8 supported by poles spaced from 120 feet to 150 feet apart. However, on new lines, the fallacy of this mode of construction is apparently being realized, and much of the new work looks different. In one case the writer has seen a pole spacing of over 500 feet in use on light lines, 40-foot poles being used, which made a very nice appearing and businesslike line. Due to the less number of poles used,

better poles, cross-arms and insulators may be indulged in. Other details may be treated in a similar manner.

DESCRIPTION OF TYPICAL SYSTEM.

The writer has been connected for several years with probably the only hydroelectric power project that depends almost entirely on pumped irrigation for a market, approximately seventy per cent of the power generated being used for this purpose, the balance of the power being used for the ordinary commercial purposes in towns and settlements within the territory served, and for the operation of one interurban railway. The entire territory, however, is supported by the agricultural and horticultural products, and, therefore, the system is believed to be almost as nearly an exclusive power pumping system as can be imagined. The actual conditions obtaining on this system should apply closely to conditions which may be expected in other similar projects.

The territory of the company referred to comprises approximately 1,050 square miles in Tulare and Kern counties, California, being a strip of country about fifty miles long north and south, and twenty-two miles wide. The only available gravity waters for irrigation are the waters of the Kaweah and Tule Rivers, all of which have been long ago appropriated. This gravity water irrigates about 90,000 acres of land and the balance of the territory, or approximately 560,000 acres, must depend entirely on the ground waters for irrigation before they can be made to produce other than grain or pasturage. The average annual rainfall for the territory is about ten inches, and the soil and climate are admirably adapted for the production of all kinds of high-class products. The territory may be for convenience divided into two sections, the citrus belt comprising approximately 200,000 acres of land, and what may be termed the valley portion. In estimating the power requirements it is considered that approximately half of the land in the citrus belt will be planted to products requiring approximately half as much water as the citrus fruits.

FORMS OF CONTRACTS AND CHARGES.

The bulk of the power is sold under three forms of contract, all being for a period of five years or longer. The contract under which the greatest amount of power is marketed, and which is used by the orange grower, is called the "continuous" rate and provides for the supply of current at the flat rate of $50 per horsepower per year, as measured at the peak load at any time during the season.

The second contract, called the "spring and meter" rate, applies to other classes of products, such as deciduous fruits, alfalfa, etc., and provides for the supply of power at a flat rate of $25 per horsepower for the period from February 1 to July 31, when the meter is cut in and all current used during the remaining six months is charged for at the rate of three cents per kilowatt-hour. The

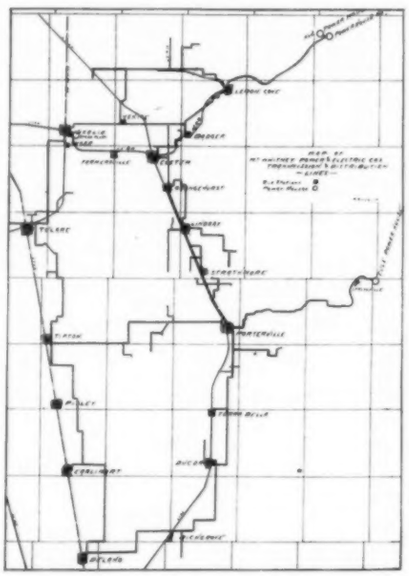


FIG. 7.—MAP OF TRANSMISSION SYSTEM.

minimum payment during the meter period is $1 per horsepower installed, per month, thereby bringing the minimum charge to approximately $31 per horsepower per year, the flat-rate charge being based on the maximum demand.

The third long-term contract applies to power for miscellaneous commercial purposes not pertaining to irrigation and consists of a meter rate with a graded base rate according to the season of the year.

Aside from the above contracts, lighting rates and a monthly power rate are in force, but include no special features.

Under the pumping contracts it is to be noted that the same rate is made on any size motor, which is most important, as the subdivision of the land into small tracts is necessary for the success of any community, and the small grower should receive all the encouragement possible.

By the installation of a double-throw switch, the flat-rate consumer is allowed the use of current for lighting purposes when not using the motor, ten sixteen-candlepower lamps being

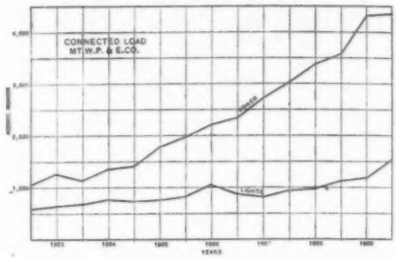


FIG. 8.—CONNECTED-LOAD CHART.

allowed for each horsepower contracted for; but, of course, this lighting is confined to the residence of the consumer. The grower generally provides a motor of one or two horsepower capacity for pumping water for domestic use, the pump operating in the day time and the lights at night. Lighting is the only use of current allowed under these conditions, although small household appliances, such as a fan motor, flatiron, vacuum cleaner, etc., may be used. Electric heating and cooking, however, are not allowed, the regular meter rate being used for this purpose.

LOAD CHARACTERISTICS AND POWER REQUIRED FOR PUMPING.

The load curve, Fig. 9, together with the connected load, Fig. 8, will show better than any individual examples the amount of power which is required for a large territory with varying

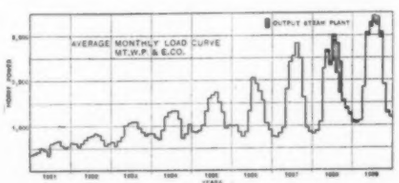


FIG. 9.—MONTHLY LOAD CURVE.

water levels ranging from a few feet to ninety feet, and with lifts above the surface at the wells varying from two or three feet to several hundred feet, there being approximately 18,000 acres of land under pumped irrigation at present.

It is estimated that one horsepower used in the ordinary way during the respective irrigation seasons will irri-

gate an average of five acres of citrus fruits and ten acres of other products in the citrus belt, and sixteen acres of deciduous fruits, alfalfa, etc., in the valley section.

The table given herewith was compiled from observation at typical pumping plants on the system. In the table the letters at the head of the columns signify as follows:

A. Number of acres of oranges.
B. Average age of orange grove.
C. Number of acres of vines.
D. Number of acres of alfalfa.
E. Horsepower capacity of motor.
F. Horsepower tested.
G. Depth of water during pumping season.
H. Height water is raised above surface of ground at well.
I. Total head.
J. Acres per installed horsepower.
K. Estimated depth of water available over land if operated continuously during period based on fifty per cent plant efficiency.

The table might be extended and averaged to show the horsepower and water required for the supply of various products and for the requirements of orange groves of different ages, but there are so many variable elements

Plant	A	B	C	D	E	F	G	H	I	J	K
1	30	5	—	—	5	5	86	4	90	6	2.9
2	40	3	—	—	5	3.0	66	4	70	8	1.8
3	54	15	—	—	12	12.1	80	5	85	4.5	6.3
4	50	3	—	—	7.5	5.2	45	5	50	6.7	4.2
5	16	13	—	—	5	4.7	87	3	90	3.2	5.1
6	20	13	—	—	5	4.5	65	5	70	4.0	5.7
7	22	12	—	—	5	4.7	65	5	70	4.4	5.1
8	10	10	—	—	2	2.4	66	4	70	5.0	4.5
9	48	11	—	—	10	9.1	70	3	73	4.8	4.4
10	40	5	—	—	5	4.6	—	—	80	8.0	2.3
11	38	3	—	—	15	12.9	20	100	120	2.2	6.3
12	16	7.5	—	—	10	10	20	100	120	1.6	8.2
13	110	2	—	—	27.5	27.6	60	5	65	4.0	6.8
14	70	3	—	—	15	15	80	—	80	4.6	4.2
15	35	8	—	—	10	7.8	40	—	40	3.5	8.8
16	195	5	100	—	80	69	20	80	100	2.7	4.6
17	66	3	—	—	10	9.7	40	—	40	6.6	3.8
18	111	2	—	—	15	15.8	27	5	32	7.4	7.1
19	140	7	—	—	50	50	60	90	150	2.8	3.6
20	145	7	—	—	50	32.8	60	87	147	2.9	2.4
21	—	—	80	—	15	12.8	28	2	30	2.0	18.8
22	120	10	80	—	47.5	60.1	80	—	80	4.2	6.3
23	—	—	74	—	15	16.2	35	5	40	5	7.2
24	—	—	—	260	10	7.0	0	8	8	24	3.9
25	—	—	—	160	5	5.6	0	16	16	32	3.5
26	—	—	—	260	15	19.2	16	5	21	17.2	5.5

FIG. 10.—DATA OF PLANT.

entering into each case that any such figures, even if based on an average of every plant on the system, would be, in the writer's opinion, practically worthless. In the case of the high-lift plants, water is usually taken from the main pipe at different levels, but, as the current is charged for at the maximum demand rate and as the pumps are designed for the highest head, only the high head is taken into consideration.

Fig. 8 shows the increase of connected load on the system from 1903 to 1909, inclusive, for power and lights. This curve does not show the railroad load, which is 600 kilowatts and was connected in February, 1908, and operates at a load factor of approximately thirty per cent throughout the year. Of the total connected power load at the end of 1909, there was a total of 3,776.75 horsepower used for the pumping of water, leaving 573.25 horsepower for commercial power purposes. This applies to all motors over one-half horsepower, sizes under this being included in lighting.

Fig. 9 shows the average monthly load curve at the generating stations for 1901 to 1909, inclusive. The shaded portion of this curve represents the load on the auxiliary steam plant, made necessary in 1908 by the disabling of one generator in No. 1 power house and an extremely low water period of the rivers; and in 1909 the steam plant floated on the line until the Tule river plant was completed late in the season, the other power stations being fully loaded.

(To be continued.)

Commission News from New York.

The New York Public Service Commission, Second District, has authorized the Olean Electric Light and Power Company to increase its common capital stock from $35,000 to $85,000 and to issue the increase of $50,000, the proceeds to be used for indebtedness incurred in additions and betterments to its plant. The conditions of the grant are that the company is required to credit to fixed capital $2,261.14, the amount charged to capital which was expended for replacements not properly the subject of capitalization.

The Commission has given a further hearing upon the application of the New York Central and Hudson River Railroad Company for the elimination of the Main and Wildey Street grade crossings of its railroad in the village of Tarrytown.

At the hearing H. J. Buell appeared for the legal department of the New York Central with Messrs. Harwood and Bardwell of the Electrical Zone Engineering department. President T. R. Pierson and Attorney C. S. Davison for the village of Tarrytown announced that the village and railroad had finally agreed upon a plan which would be satisfactory to all concerned. Other residents of Tarrytown present also agreed that this was the fact. It was found, however, that in the new plan agreed upon some property owners who are concerned had not been made parties to the proceeding, and as soon as the final estimate is prepared as to the cost of the revised plan, a further hearing will be given at which time these property owners will have an opportunity to appear.

The Commission also recently gave a hearing upon the petition of the Newburgh Light, Heat and Power Company for permission to extend its line and to begin construction in the village of Montgomery, Orange County and the town of Gardiner, Ulster County.

The company also asked authority to issue $70,500 in first mortgage bonds to cover cross construction of the transmission line which should be fifteen miles with two substations.

John L. Wilkie appeared for the applicant. Testimony as to the cost of installation of the line was given by Electric Engineer H. M. Buegler. There was no opposition to the granting of the applications. Decision was reversed.

Niagara power is proposed to be delivered in municipalities in Livingston and Monroe counties, through the Livingston-Niagara Power Company, by a transmission line from the Niagara, Lockport and Ontario Power company. Representatives of the Livingston-Niagara Power Company were recently before the Public Service Commission, on an adjourned hearing on its applications to begin construction of an electric current distributing plant at Golah, Livingston County and authority to execute a mortgage for $300,800. An equal amount of bonds thereunder was applied for and the right to issue $100,000 common capital stock was asked.

Attorneys John F. Connor and Clarence R. Shauster presented the case of the Livingston-Niagara Power Company, and the companies now operating in the regions sought to be served were represented by Attorneys Edwin D. Hamlin, Alfred L. Becker and Clinton H. Quimby. Five companies now furnish electricity there and the new company intends to wholesale power to them and reach localities which are not served by them. Q. W. Hershey, an electrical engineer, who prepared the estimates, stated that the applicant company would develop a maximum of 2,000 horsepower and distribute it by three transmission lines from Golah. He gave evidence showing the need for the service which it offers. The commission reserved decision in the matter.

Railway Signal Association.

The next annual meeting of the Railway Signal Association will be held at the Hotel Jefferson in Richmond, Va., on October 11.

The National Electrical Contractors' Association.

The cooling sea breezes, the many amusement attractions of the ever popular Atlantic City, combined with the fact that this was the occasion of the tenth annual meeting of the National Electrical Contractors' Association of the United States, brought out the largest gathering of the members of this association that had ever appeared at an annual meeting.

Headquarters were established at Young's Hotel, where committee rooms, reception parlor for the ladies, and a booth for registration of the members, manufacturers and their representatives and the guests of the association were engaged.

The open meetings and the executive sessions were held at "The Chapel" at the ocean end of Young's Million Dollar Pier. The convention was formally opened at 9:30 o'clock on Wednesday, July 20. Addresses of welcome were delivered by C. E. Ingalls, president of the New Jersey Contractors' Association, and by Hon. Franklin Stoy, mayor of Atlantic City. President Sanborn responded to the welcoming addresses and introduced Washington Devereux, of Philadelphia, Pa., who read a paper, entitled "Fire Insurance Supervision of Electrical Installation," which was listened to with much interest.

Mr. Devereux was followed by G. E. Bruen, of New York, N. Y., who represented the National Fire Protective Association. Mr. Bruen read a most interesting paper on "Electrical Inspections."

Mr. Bruen was followed by Charles L. Eidlitz, who talked on "How a Contracting Business Should Be Conducted to Make Money." He related experiences and gave information of much value and interest to the contractors.

After this meeting, the members and their guests enjoyed a sea bath, bathing suits being furnished to all from Reid's Bathhouse on the Boardwalk.

At 2:00 p. m. a business session for members only was held in "The Chapel," where reports of committees were heard and other routine business taken up and disposed of. During the progress of this meeting, the ladies and guests of the association were taken charge of by the entertainment committee and for several hours enjoyed a roller-chair ride on the famous Boardwalk.

In the evening a smoker was held for the guests and members at the New Berkley Hotel, where good talent was provided and refreshments were served. Cigars, cigarettes and souvenirs were distributed through the courtesy of the Trumbull Electric Manufacturing Company, of Plainville, Conn., represented by F. D. Watson and other members of this well-known company's sales organization. During this time the ladies, escorted by the entertainment committee, visited Young's Million Dollar Pier.

On Thursday an open session was held at "The Chapel," beginning at 9:30 a. m. This meeting started with a paper, entitled "Welfare Work," with special reference to safeguarding wage earners against industrial accidents, read by Louis B. Schram, chairman of the committee on factory inspection of the National Civic Federation.

Mr. Schram was followed by William A. Boring, architect, of New York, with a paper on "Relations Between the Architect and Contractor."

Paul F. Bauder, of the engineering department of the National Electric Light Association, then talked to the members on the latest developments in incandescent lamp manufacture. He, in addition, pointed out the advantages of a course of studies on illuminating engineering opened to electrical contractors and others by the Johns Hopkins University. His remarks were of great interest and his suggestions were freely discussed and many questions asked. The association endorsed this course of studies and recommended that the members take advantage of it.

At 2:00 p. m. an executive session for members only was held. The secretary of the association, H. Morton, of Utica, N. Y., reviewed in detail the history of the association from its conception up to the present time. He pointed out how the membership had grown from year to year and urged that the members co-operate and put forth every effort to double the present membership during the coming year. A campaign will be conducted with this end in view, and the officers and members are confident that this result will be accomplished.

Secretary Morton was highly complimented at this meeting on the success of "The Universal Data and Sales Book," the usefulness and importance of which has been recognized by every member. Basic plans for this important book were made at the Toledo meeting of the association held in July, 1909. After four months' labor on the part of the executive committee and secretary of the association, a distribution of these books was made to the association last December. They are made up in loose-leaf binder form, so that the sheets may be replaced with the latest data available and new information added from time to time. The sheets contained in this book have been compiled under the supervision of the executive committee to show the list price of practically all the material used in the electrical contracting business, and the price at which such material may be sold to the consumer, according to the committee's past experience. There is no understanding or agreement on the part of the association, or among its members or otherwise, fixing, or in any way affecting, the selling price of the material listed, and the association intends that the figures given are only suggestions for the convenience of members in determining what may be considered just and reasonable retail prices. The members are not restricted in any way to the purchase of the material listed in this data book, and it is the spirit of those in charge of the compiling of it to invite every manufacturer to supply information for the proper listing of his products. The gathering and presenting of this detailed information in this form is an accomplishment that the officers and members of the association may be justly proud of.

During the following year, data on the prevailing rate of wages in cities of over 10,000 inhabitants will be collected by Secretary Morton and sheets containing this information will be distributed to the members; also they will be supplied through the medium of this book with information as to the cities licensing electrical contractors and as to the fees charged in this connection. A number of city councils have adopted measures making it necessary for the electrical contractor to be licensed. It appears that the necessity for this is becoming more and more apparent and that it is likely that a number of the state legislatures will consider this question soon.

At this business session, the following officers were elected for the ensuing year:

President, M. L. Barnes, Troy, N. Y.; first vice-president, Chas. R. Kreider, Chicago, Ill.; second vice-president, H. S. Potter, Boston, Mass.; third vice-president, J. C. Hatzel, New York, N. Y.; treasurer, John R. Galloway, Washington, D. C.; secretary, W. H. Morton, Utica, N. Y.; sergeant-at-arms, J. C. Sterns, Buffalo, N. Y.; directors, J. T. Marron, Rock Island, Ill.; Ernest Freeman, Chicago, Ill.; G. M. Sanborn, Indianapolis, Ind.; S. B. Wetherbee, Boston, Mass.; E. McCleary, Detroit, Mich.; W. J. Chapman, Minneapolis, Minn.; W. L. Hutchinson, Kansas City, Mo.; P. N. Thorpe, Paterson, N. J.; James R. Strong, New York, N. Y.; M. L. Barnes, Troy, N. Y.; James Hilton, Syracuse, N. Y.; J. C. McMaster, Columbus, O.

The attention of the meeting was called to the fact that Secretary Morton and Sergeant-at-Arms Sterns have held their offices for ten successive years, and a vote of thanks was tendered these gentlemen by the Association in appreciation of their continued valuable services and loyalty to the Association.

With a neat presentation speech by James R. Strong, retiring President G. M. Sanborn was made the recipient of a handsome Swiss repeater watch.

The convention next year will be held at Niagara Falls, N. Y.

Thursday afternoon, ladies and guests were entertained by a trolley ride to Ocean City, and in the evening a dinner was served for the ladies at Young's Hotel. After this dinner, The Sons of Jove held a rejuvenation in the gardens of the Windsor Hotel, at which twenty-six new members were initiated. The members spent all day Thursday on an outing at the Inlet. A luncheon and shore dinner was served. In the afternoon there was an exciting game of baseball between the eastern and western teams, captained respectively by James R. Strong and E. McCleary. The Easterners carried off the honors by a score of 14 to 6.

The manufacturers were well represented, the registration showing that there were more present than at any previous meeting.

Among those present were:

Frank H. Schwartz, Frank H. Schwartz Electric Company; W. B. Morse, Berlin Mills Company; O. D. Allen, C. L. Boynton, Electrical Products Company; J. K. Tompkins, C. S. Knowles Company; E. L. Hide, P. E. Mansfield, Holophane Company; H. E. Monk, W. R. Ostrander & Company; G. C. Knott, Benjamin Electric Manufacturing Company; Chas. M. Proctor, H. C. Herbert, P R Manufacturing Company; W. E. St. Urley, H. H. Hornsby, Sprague Electric Company; W. G. Campbell, Steel City Electric Company; W. C. Robinson, National Metal Molding Company; E. Ward Wilkins, Partrick, Carter & Wilkins; J. A. Vaughn, H. C. Roberts Electrical Supply Company; Frank Stout, Bryant Electric Company; R. B. Corey, E. C. Richards, American Circular Loom Company; E. E. Pines, Federal Electric Company; Thos. H. Bibber, Edwards & Company, Inc.; C. F. Schondelmeier, Waterbury Company; E. G. Mack, E. C. Muller, Crouse-Hinds Company; P. T. Lyons, P. M. Toristall, C. W. Abbott, National India Rubber Company; T. M. Warner, E. D. McCracken, John A. Roebling's Sons Company; R. B. Cressman, Pass & Seymour, Inc.; R. C. Smith, Safety Insulated Wire & Cable Company; E. S. Keefer, H. D. Brainard, W. A. Bezan, J. H. Pierson, Jr., Western Electric Company; Paul Garland, Westinghouse Electric & Manufacturing Company; Herbert Rice, Cutter Electrical & Manufacturing Company; H. W. Leithold, Novelty Electric Company; N. L. Crawford, W. N. Matthews & Brother, C. E. McGuire, G. M. McDowell, E. H. Freeman Electric Company; F. D. Watson, J. H. Jacobson, Trumbull Electric Manufacturing Company; C. McKey Parr, Hart & Hegeman Manufacturing Company; A. D. Miles, H. W. Johns-Manville Company; A. S. De Veau, De Veau Telephone Manufacturing Company; A. P. Munning, Cutler-Hammer Manufacturing Company; W. M. Winship, W. T. Thomas, H. T. Paiste Company; W. A. Linder, Starbuck Sprague, Oscar Carman, C. A. Walker, H. W. Kilkerney, General Electric Company; E. R. Ramsey, Penn Yan Flexible Conduit Company; P. H. Hover, New York Insulated Wire Company; H. B. Kirkland, Fred. W. Mason, American Conduit Manufacturing Company; C. B. Ellis, Manhattan Electrical Supply Company; H. T. Macgregor, D & W Fuse Company; A. S. Merrill, Chicago Fuse Wire & Manufacturing Company; C. J. Marsh, P. S. Hopkins, T. E. Hughes, Standard Underground Cable Company; T. J. Cope, of Philadelphia; Russell Howland, Jos. Goldmark, Paul F. Bauder National Electric Lamp Association.

Limitations of the Weston Cell.

At a recent meeting of the Physical Society of London, S. W. J. Smith read a paper discussing the experiments of F. E. Smith on cadmium amalgams. Theory and experiment suggest that there is no range at any temperature over which the electromotive force of a Weston cell is absolutely independent of the percentage of cadmium in the amalgam. Even if the materials are pure, the existence of surface energy must cause some variation. Within the range over which the electromotive force is usually taken as constant the electromotive force appears to rise, very slowly, with increase in the cadmium content. The rate varies, but is never more than a few millionths of a volt for one per cent cadmium. Fom the data it seems possible also to discover the precise way in which the use of the richer two-phase amalgams may lead to variability of the electromotive force of the Weston cell. The interpretation advocated is that the irregularities are due to electrolytic skin effects arising out of want of uniformity of composition of the surface grains. The probable reason why the temperature coefficient of electromotive force of a Weston cell, always small, actually vanishes near zero degrees centigrade, is indicated.

At the annual convention of the Bunsen Society in Giessen, Professor Cohen of Utrecht read a paper upon the same subject, in which the behavior of cadmium amalgams at different temperatures was investigated. The temperature diagram of cadmium amalgam is very complicated. On cooling the liquid amalgam, a heterogeneous mixture of liquid and solid is first obtained, which solidifies in crystals composed of both elements. In the heterogeneous mixture the electromotive force is independent of the temperature. This phase exists for a range from minus four to plus forty degrees centigrade for an eight-per-cent (by weight) amalgam, and the author considers this amalgam superior to the 12½ per cent amalgam, which has not met the requirements. He has constructed cells of this composition which are entirely satisfactory.

No Receiver for United Wireless Company.

John B. Stohl of New York, a minority stockholder in the United Wireless Telegraph Company, was heard in the Supreme Court on a petition to have a temporary receiver appointed for the company. Justice Bird denied the petition without prejudice on the ground that the allegations of illegal issue of stock had not been sustained by the evidence.

New Western Union Division.

According to a recent report, a new division is to be created by the Western Union Telegraph Company. Dallas, Tex., will be the headquarters. The division which is to be known as the "Gulf division," will comprise the states of Texas, Oklahoma and Louisiana.

Louis McKissick, assistant general superintendent of the Western division, will be in charge.

The exports of copper from the United States in the fiscal year ended June 30 last, amounted to $83,500,000, as against $100,000,000 in the preceding year, 1908-09.

Arrangements for Electric Club Picnic.

At the meeting of the Electric Club, of Chicago, on Wednesday, July 20, announcement was made by George H. Porter, chairman of the entertainment committee, of the final arrangements for the annual picnic, which is to be held Saturday, August 6, at Ravinia Park.

Arrangements have been made for a special train which will leave the Chicago and Northwestern Station at 10:15 a. m., arriving at the park at 11 a. m. In addition to various athletic sports for members and ladies, for which there will be prizes for all events, there will be dancing in the pavilion and concerts in the afternoon and evening by the Walter Damrosch Orchestra. A baseball game between the married men and single men is being arranged and indications point to an interesting contest. The entertainment committee is sparing no expense in providing for the entertainment and comfort of those who attend and a most successful outing is anticipated.

Old Company Dissolved.

At a special meeting of the stockholders of the Edison General Electric Company, recently held at he General Electric Company's Schenectady plant, the dissolution of the Edison General Company was approved.

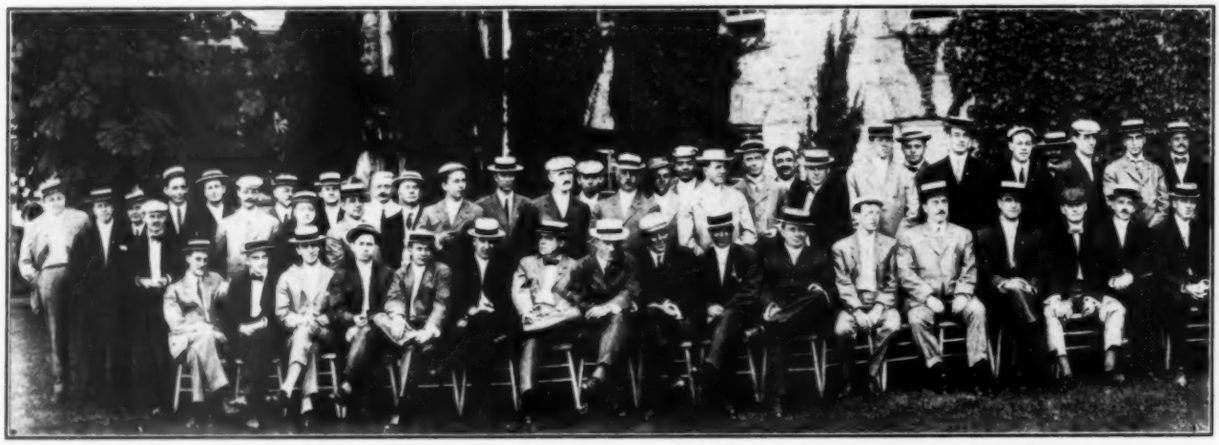
The Edison Company has existed only in name, having been continued because of certain patent rights. The reasons given for dissolution are that now there will be a greater simplification of the business of the General Electric Company, and a marked reduction in the expenses of the company.

Midsummer Meeting of National Electrical Jobbers' Association.

The midsummer meeting of the National Electrical Jobbers' Association was held at the Hotel Clifton, Niagara Falls, Ontario, on Tuesday, Wednesday and Thursday, July 19, 20 and 21. The discussion of matters relating to the business of the jobbers occupied several daily and one evening session, the chair being occupied by Franklin Overbagh, president of the association. The fall meeting, which will be held in October, will go to Hot Springs, Va.

Niagara Falls, in all its summer glory, proved a delightful meeting place, the weather conditions being perfect, and the vacation season attracted a splendid representation of jobbers, supply men, and manufacturers. A highly pleasing feature of the convention was the large attendance of ladies and children, marking this as one of the most wholesome and satisfactory of the electrical fraternity. On Wednesday afternoon a lively baseball game between the jobbers and the manufacturers resulted in a victory for the former by a score of 6 to 5. During the game H. H. Ardmore, W. N. Matthews and F. M. Bernardin distinguished themselves in the cause of the treasury, making an investment of $2.50 for chewing gum, cigars and field seats, and turning in $36.06 as a result of their efforts.

Among those present were the following: Oscar Turner, Southern Wesco Supply Company; Ross D. Holabird, Holabird-Reynolds Electric Company; W. C. Bryant, Bryant Electric Company; E. R. Grier, Arrow Electric Company; C. I. Hills, P. S. Klees, Franklin Electric Manufacturing Company; Charles E. Brown, Central Electric Company; Frank R. Bryant, Crescent Sales Company; W. P. Crockett, W. P. Crockett Company; L. O. Duelos, A. E. Duelos, Massachusetts Chemical Company; Frederic Greer, Harvard Electric Company; Thomas G. Grier, Thomas G. Grier Electric Company; E. H. Haughton, Bryan-Marsh Company; Henry F. Holland, Simplex Electric Heating Company; George Van W. Ingham, Pass & Seymour Company; Edward B. Kittle, Sprague Electric Company; George C. Knott, Benjamin Electric Manufacturing Company; W. W. Low, Electrical Appliance Company; D. L. Markle, Mark Manufacturing Company; Leo G. Mockenhaupt, Thomas G. Grier Company; E. M. Scribner, Arrow Electric Company; George S. Searing, Hart & Hegeman Manufacturing Company; W. A. Stacey, Bryant Electric Company; Roy M. Van Vleet, Cutler-Hammer Manufacturing Company; R. L. Wildauer, American Circular Loom Company; James Wolff, New York Insulated Wire Company; George Cutter, George Cutter Company; J. B. Terry, J. B. Terry Company; Max McGraw, Interstate Supply Company; H. W Dyer, Western Electric Company; C. L. Hight, Henry D. Sears; Frank S. Price, Pettingell-Andrews Company; F. M. Bernardin, B.-R. Electric and Telephone Manufacturing Company; W. N. Matthews, W. N. Matthews & Brother; Thomas T. Richards, Wagner Electric Manufacturing Company; A. D. Page, General Electric Company; S. H. M. Agens, Electric Motor and Equipment Company; Frank R. Morris, Robertson Cataract Company; Avery P. Eckert, National India Rubber



GROUP AT MIDSUMMER MEETING OF NATIONAL ELECTRICAL JOBBERS' ASSOCIATION—LEFT HALF.

Company; M. A. Oberlander, Western Electric Company; James B. Olson, Habirshaw Wire Company; James A. Pizzini, Western Electric Company; W. D. Steele, Benjamin Electric Manufacturing Company; E. W. Rockafellow, Western Electric Company; Joseph E. Montague, Buffalo and Niagara Falls Electric Light and Power Company; B. B. Downs, St. Paul Electric Company; Thomas C. Ringgold, General Electric Company; John W. Brooks, W. Brewster Hall, L. S. Baldwin, Victor R. Despard, Pass & Seymour Company; Edgar G. Bernard, E. G. Bernard Company; C. M. Crofoot, Crouse-Hinds Company; George L. Patterson, Stanley & Patterson; F. S. Terry, B. G. Tremaine, J. Robert Crouse, Paul Bauder, A. E. Williams, National Electric Lamp Association; N. C. Cotabish, pany; F. S. Hunting, Fort Wayne Electric Works; H. B. Crouse, Crouse-Hinds Electric Company; B. M. Downs, Brookfield Glass Company.

On Thursday afternoon and evening a conference of sales representatives of the Western Electric Company was held at the Clifton, led by Mr. Rockafellow.

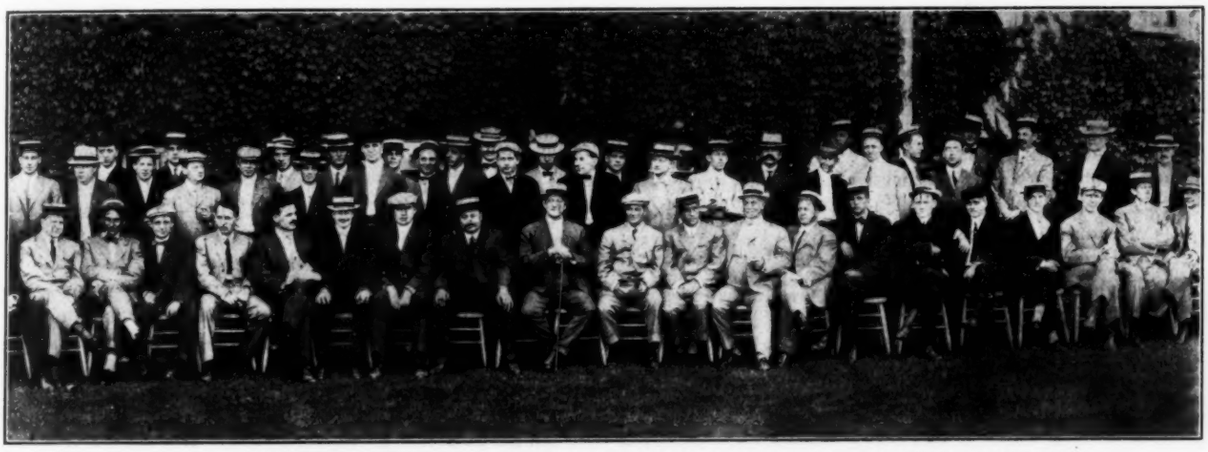
International Municipal Congress and Exhibition.

The following statement has been issued by Edward H. Allen, general manager of the International Municipal Congress and Exposition to be held in Chicago, September 18-30, 1911:

"There will be no charge for admission to the Congress and Exposition, either to accredited delegates or exhibitors. There will be no charge to municipalities for space in which to display their exhibits. Space allotted to manufacturers and others submitting such exhibits as are acceptable to the management will be charged for at the rate of $2.00 per square foot. The broad and generous policy which has been adopted for carrying out this magnificent enterprise is the result of several years' preliminary work and is vouched for by master minds deeply interested in municipal betterment. If there is anything in your line that is of direct interest to a municipality, such work is available for exhibition. It would seem unnecessary to bespeak your interest from a commercial viewpoint. Visual methods are the order of the moment and every exhibit installed will be inspected by official representatives of the municipalities of the world."

The Congress will be participated in by duly appointed delegates from all of the principal cities of the world, together with members of national and international organized bodies concerned in any particular branch of civic work or in clean, economic municipal government as a whole. The world's brightest minds will deliver to the Congress papers bearing on special lines of municipal undertaking.

The Exhibition will comprise the works of the great inventors and manufacturers of the world by whom will be installed comprehensive displays and operating exhibits to illustrate all branches of modern municipal undertaking; building construction and material; manufacturing; engineering; paving; road building; parks and playgrounds; street lighting; transportation systems; telephones; garbage collection and disposal; street cleaning and sprinkling; fire and police organization and equipment; sanitation and health; hospital, school and library appurtenances; erection equipment; fireproofing problems; dust-proofing highways; street washing machines, etc.



GROUP AT MIDSUMMER MEETING OF NATIONAL ELECTRICAL JOBBERS' ASSOCIATION—RIGHT HALF.

H. E. Hackenberry, National Carbon Company; H. H. Cudmore, Brilliant Electric Company; D. C. Hemingray, Hemingray Glass Company; A. O. Keleher, C. S. Davidson, Holophane Company; Fred Bissell, W. S. Bissell, F. Bissell Company; J. B. Esterbrook, E. N. Beach, Colonial Electric Company; Robert E. Gorton, New York & Ohio Company; E. E. Nash, Warren Electric and Specialty Company; E. J. Kulas, Tungstolier Company; C. E. Corrigan, National Metal Molding Company; L. H. Keller, Union Electric Company; W. S. Sisson, D. & W. Fuse Company; R. H. Mansfield, H. P. James, Cutler-Hammer Manufacturing Company; H. P. Andrae, Julius Andrae & Sons Company; Paul F. Sise, R. Edwards, M. S. Pierce, Northern Electrical Manufacturing Company; James Richardson, Electric Machinery Com-

Electrical Medical Apparatus in Demand in Europe.

A business man in a European country advises an American consular officer that he desires catalogues, price lists, and full particulars of apparatus of high-frequency currents for medical use. He has already purchased apparatus in the United States, but desires catalogues from other manufacturers. Correspondence may be in English. The address of the inquirer may be obtained by writing to the Bureau of Manufactures, Washington, D. C., quoting File No. 5248.

Ohio Electric Light Association.

Special dispatch to the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

CEDAR POINT, OHIO, JULY 26.—The sixteenth annual convention of the Ohio Electric Light Association opened today under most auspicious circumstances, there being a large attendance of enthusiastic members, and perfect weather. The morning session was taken up with the organization of the meeting.

At the afternoon session the address by the president, J. C. Rothery, was delivered.

The association was welcomed by E. A. Beckstein, of the Sandusky Gas and Electric Company. The secretary then read his annual report, and the amendments to the constitution were considered but laid on the table without definite action.

The meeting then proceeded to the reading of papers, the first on the programme being one by W. C. Anderson entitled "Low Pressure Turbines and Their Operation." This was read by the secretary.

LOW PRESSURE TURBINES.

In steamship practice a coal consumption of one and one-half pounds of coal per indicated horsepower-hour, including all auxiliaries, is not unusual. In the small lighting plant with high-speed engines the coal consumption is nearly four times as great to develop the same energy. In order to improve the economy of such small stations requires the discarding of the old generating equipment, which is justifiable chiefly when considerable new off-peak load can be secured. By the use of the low-pressure turbine, where condensing water is available, the economy can be greatly improved without discarding the investment in engines, etc., already made. The small non-condensing plant can be improved only by selling its exhaust steam for heating or changing to a condensing system. In the latter case arrangements must be made for carrying the highest possible vacuum. By improvements in condensing equipment it is now possible to maintain a vacuum of twenty-eight inches or over easier than it was to maintain a twenty-six-inch vacuum formerly. Mr. Anderson spoke of the great flexibility attainable by the use of a turbine, as shown by a 580-kilowatt unit installed in his plant. This is operated floating on the line and using such exhaust steam from the non-condensing engines that is not needed in the exhaust-steam heating system.

The next paper was by Frank Brosius on "Turbine Troubles" and was read by F. M. Tait.

TURBINE TROUBLES.

This paper deals chiefly with troubles coming to Mr. Brosius' attention while operating two 500-kilowatt and one 1,500-kilowatt vertical Curtis turbines. The first trouble touched on is the loss of pressure on the oil or water used in the step bearing. If the step bearing is dropped there is imminent danger that the buckets will rub, so the turbine must be stopped immediately. In one instance the stop on the large unit was lost and soon every intermediate bucket was stripped. Although the loss of the step bearing in the early days of the Curtis turbine was more frequent, it did not give as much trouble as hot cranks on the old high-speed engine. To ensure keeping the pressure on the step bearing the step pumps must be frequently packed. For the smaller units motor-driven triplex step pumps were installed for regular service and an automatic steam pump for emergencies; the latter starts up as soon as the pressure drops five pounds. The steam end of this pump must be kept drained and the pump must be tried occasionally by dropping the pressure on the electric pumps. The top, middle and bottom bearings must be kept in perfect condition and alinement or trouble results from vibration. Proper lubrication must be provided without flooding the bearings with oil. To prevent the throwing of oil into the generator tight-fitting felt collars were placed around the shaft above the middle bearing and below the top bearing. Sticking of the controling valves gave trouble till they were fitted with two cast-iron snap rings each. To prevent leaking the needle valves must be watched constantly and kept tight. The coils on the solenoid-controlled valves were burned out so that the needle valve could not be controlled. The mechanically operated valves gave practically no trouble. Carbon packing rings on the shaft to seal the turbine for vacuum must be very carefully fitted and occasionally refitted to prevent any leaks. Mr. Brosius prefers the water step bearing to the oil step because it eliminates one set of carbon packings. The generator must be kept thoroughly clean and free from oil or condensed steam. There has been considerable controversy on the effects of superheated steam on cast-iron pipe fittings. It seems to be conceded that sudden and high temperature changes are injurious to cast-iron fittings, unless they are of the finest quality close grained metal. Foundries do not take the trouble to turn out such castings; therefore it is practically imperative to use steel fittings for superheated steam, to be on the safe side. Mr. Brosius concludes his paper by giving the results of wear on two almost identical high-pressure cylinders of adjoining compound engines. One served excellently, showing but slight wear after six years of continuous service; the other wore rapidly, shoulders had to be cut out on both ends several times and the cylinder twice rebored, finally being provided with a cast-iron bushing which has given good results for two years. This difference in service the writer attributed entirely to the difference in quality of castings.

After a brief discussion of these papers, the meeting adjourned.

A. A. G.

Peat as Fuel.

The following is an abstract of a recent report by Consular Agent John B. Brewer, of Wiesbaden, Germany.

A civil engineer, having his experimental plant in this district, has found and patented a very simple process for extracting water from peat.

The briquets made from the material so treated furnish a fuel which appears far superior to the best coal, as to calorie power, low price, small specific weight, and absence of smoke and ashes.

The freeing from water is accomplished by the admixture of peat-coke to the peat before pressing in the proportion of 1 to 15. As no extraneous substance is used, there is complete independence from other ingredients. The pressing proper is done by specially constructed and patented machinery of a simple kind.

A copy of the inventor's prospectus is on file in the Bureau of Manufactures, Washington, D. C.

Westinghouse Annual Meeting.

At the annual meeting of the stockholders of the Westinghouse Electric and Manufacturing Company, held at Pittsburg on July 27, the following directors were re-elected: A. G. Becker, George M. Verity, William McConway, Charles A. Moore. A vote of the stockholders confirmed the selection of Robert Mather and T. W. Lamont to succeed E. C. Converse and Neal Rantoul, who had previously resigned.

Mexican Hydroelectric Developments.

A recent issue of the *Mexican Herald* states that the Department of Fomento has received eleven applications from different parties for concessions to use the waters of rivers and lakes in several of the states in the republic to generate electric energy for irrigation and other commercial purposes. In all 60,862 liters of water per second will be used. The names and addresses of the applicants, can be obtained by interested parties upon application to File No. 5260, Bureau of Manufacturers, Washington, D. C.

Marine-Engine Draftsmen.

The United States Civil Service Commission announces that an examination will be held on August 24 and 25 to secure eligibles for the position of marine-engine draftsmen.

Those wishing to take the examination should apply to the United States Civil Service, Washington, D. C., or to any examining office for Form 1312. Applicants must have had at least ten years' experience.

Automobile Exposition in Argentina.

Consul Henry P. Coffin writes that arrangements are being made in Argentina to hold an Automobile Exposition in Rosario during the months of November and December of this year. All the different automobiles of Europe will be exhibited.

Norwegian Experiments in Electric Smelting.

Consul P. Emerson Taylor, of Stavanger, says that in a recent lecture before a Norwegian technical society Professor Farups reached the conclusion that electric smelting is a success only in the finer grades of steel, such as that used in the best cutlery. He concludes that for most of the common grades of steel the process is too expensive at present, compared with the usual method of smelting by coke or charcoal. He says it is not the cheapness of the process that assures it success, but the superior quality and character of the product, and this especially in the finer grades of steel. In answer to an inquiry from the consul, Professor Farups writes that plans are now under way for the smelting of iron ore by electricity at Odda, in western Norway, and that an oven of the kind used at Dommarfvet will be installed for use at Odda. A copy of the complete lecture in the Norwegian language will be loaned to those interested by the Bureau of Manufactures, Washington, D. C.

Electric Line in Liege, Belgium.

In furnishing information concerning a proposed electric line of railway to connect Liege with the surrounding Belgian towns, plans of which are not yet definitely agreed upon, Consul H. Abert Johnson reports that it is proposed to build a double-track electric line encircling the entire city, for which some 76,000 tons of rails and fifty cars will be necessary, besides a good deal of work along the line, such as paving new ways, repaving old ways, building sheds, work-shops, etc., will be called for; consequently American exporters of tramway materials may be able to furnish at least some of these supplies. In transmitting the address of the proper party with whom those interested may communicate, in French, which is on file in the Bureau of Manufactures, Washington, D. C., Consul Johnson says he will be glad to receive and turn over to this party any advertising matter that may be sent to his office.

Index of Refraction for Electric Waves.

In a recent bulletin of the Academy of Science of Krakow, Professor Merczyng describes measurements of the indices of refraction of liquids for electric waves of length 4.5 centimeters. The electric waves were generated by a Righi oscillator, and were measured by means of the interference produced by reflection at two metal surfaces, one a little in front of the other. The indices of refraction of the liquids were calculated by Fresnel's formula from observations of the relative intensities of the incident beam and the beam reflected from the surface of the liquid. They lie, for the five liquids tested, between the indices found previously by the late Professor Drude for waves of 75 centimeters and the values for light waves.

Large British Exhibit for Turin Exposition.

In connection with the tour which Consul James E. Dunning is making through the United States to explain to American manufacturers the importance of the World Exposition in Italy in 1911, the following from the London *Chamber of Commerce Journal* is of interest:

Arrangements have been made for British participation on a large scale in the International Exhibition, at Turin, next year in commemoration of the proclamation of Rome as the capital of Italy. The British section will occupy one of the best sites in the grounds, covering over seven acres, and the buildings will be of great architectural beauty. France, Germany, the United States, Argentina, Japan, Hungary, China, Brazil, Chile, Siam, and other countries are also participating in the exhibition.

British Imports and Exports.

For the first five months of 1910, Consul-General John L. Griffiths, of London, says that British imports aggregated $1,362,438,986, an increase of twelve per cent over the same period of 1909. The exports, at $826,263,905, were fifteen and one-third per cent greater, while the re-exports, at $228,378,168, were twenty-one and two-thirds per cent larger.

Resistivity of Alloys.

The idea that the high electrical resistivity of alloys was due to thermo-electric forces set up at the points of contact of the constituents of the alloys, has been proven untenable by K. P. Brooks, who, in *Physikalische Zeitschrift* for May 15, describes his measurements of resistivity at different temperatures of columns consisting of a large number of thin gold and silver disks, and of sticks of compressed gold and silver dust. He has found that their resistivity and their temperature coefficient of resistivity lie between those of their constituents, and vary with composition according to the ordinary law of mixtures. Alloys of the two have, on the contrary, higher resistivities and lower temperature coefficients than have their constituents.

New Traction Merger.

An important deal has been consummated whereby the newly formed Philadelphia & Wilmington Traction Company, with a capital of $6,500,000, will be the holding concern for all of the Interstate Railways Company properties south of Philadelphia. They are merged with the Wilmington Light & Power Company. The negotiations have been in progress for several months. The properties are all acquired by leases of 999 years. O. T. Crosby, of New York, will be president.

Examination for Steam Engineer.

The United States Civil Service Commission announces an examination for a first-class steam engineer, and for two second-class or assistant steam engineers in the United States Post-Office, Custom-House and Court-House Building, Cleveland, O. Both of the examinations will be held at the regular places throughout the United States on August 10.

Those wishing to take an examination should apply either to the United States Civil Service Commission or the secretary of the Board of Examiners for Form 1800.

British Investments Abroad.

The London *Financial News* estimates that British investments in one foreign country only—Argentina—aggregate $1,500,000,000. That this enormous total is about correct is evidenced by the fact that at the beginning of 1910, the total of Argentina securities admitted for dealings on the London stock market was about $1,403,610,000.

Railway Electrification in Argentina.

The Central Argentine Railway Company will soon electrify its Retiro-Ballester and Retiro-Tigre suburban services.

THE GROUNDING OF SECONDARIES.

DISCUSSION AT THE ST. LOUIS CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

An abstract of the report of the Committee on Grounding Secondaries made at the St. Louis Convention of the National Electric Light Association was presented in our issue of May 28, but as the discussion upon this report was postponed to a later session of the convention, it could not be given at that time. The discussion was opened by Farley Osgood, who spoke as follows:

This subject can best be discussed under four headings, namely: Why, when, where and how should secondaries be grounded.

Why to Ground.—The principal reason to ground and the chief benefit derived therefrom is the protection afforded human beings from the danger of injury, especially fatal injury, by electric shock. A secondary benefit is the lessening of the fire hazard when the secondary system is grounded. If the eminent engineers and men of extensive and varied experience now considering the problem, can unanimously agree that it is a good thing to do from a fire hazard standpoint, and a most desirable thing to do from a life hazard standpoint, it seems well that the Board of Fire Underwriters controlling the Code instructions, make their rule on this subject mandatory for the sake of humanity, even though certain branches of the electrical industry may not enjoy such a decision for purely selfish and chiefly financial reasons.

When to Ground.—As the National Electric Light Association approved at their 1909 annual convention of the grounding of secondary systems up to and including 150 volts potential and this approval, as I understand it, receive the unanimous concurrence of the members of the present committee, it seems unnecessary at this time to deal with potentials up to the 150-volt mark, but only with higher secondary voltages. As there are to my knowledge only two or three systems in the United States having, under normal conditions, a secondary voltage exceeding 300 volts, it seems unfair and undesirable to allow these few exceptions to govern the general broad problem. The present Code limits its secondary voltage allowances to 300 volts, which is the standard factory secondary pressure, so I think that voltages in excess of 300 need not be considered in our attempt to gain a unanimous final answer. These special cases of pressures higher than 300 volts will, without doubt, in the course of time be changed to a more conservative rating, and until such time is reached, they can be governed by special rulings or be left to their own judgment, rather than be allowed to upset the accepted standard practice of the rest of the country. We consider then only the question as to whether or not the risk to human life on secondary systems from 150 to 300 volts potential is greater when such systems are grounded than when they are not. The effect on the human heart of an electric shock at a given voltage from a wiring system which is grounded is certainly more severe than when such a system is not grounded, as the electric circuit through the human body is much more perfect on the grounded system. As this fact is generally known and accepted by men in the electrical industry, we are immediately confronted with the question "Why subject our patrons to this known hazard?" We are again immediately advised that a potential of 300 volts will kill and this fact is put forth by men making such statements as an additional reason against the grounding of secondary systems of such a potential.

The very fact that the hazard from a grounded 300-volt system is known rather than unknown seems, to my mind, to be the very strongest reason for having such a condition of affairs, rather than subject our patrons to the unknown hazard of electric shock from unknown and uncontrolable voltages which might be received from contact between the secondary and primary or transmission system. The failure of electrical appliances between the secondary and primary systems can be fairly well cared for, but such means of protection are far from certain and very often impossible when the secondary system receives its dangerous potential from an accidental and unexpected cross with the high pressure system. For this reason the known risk of a grounded 300-volt system with its additional protection in case of contact with a higher pressure system, is much more desirable than an ungrounded system depending wholly on the insulating and protective devices between it and the high pressure system under ordinary circumstances, with no certain protection at all from direct crosses with the system of dangerous potential. Those men who state that 300 volts will kill cannot prove, from the statistics available, that 150 volts would not kill the same people. Having determined that grounding up to 150 volts is desirable, I fail to see how they can confidently state that the next step of 150 volts is undesirable.

Human beings who have lost their lives from electric shock at 300 volts potential have been very few, according to all the records available; yet, a great number of people, who have received an electric shock of 300 volts have received no injury whatever, and this great number cannot be determined, as it is such an ordinary occurrence that no record is made of them. This would seem to bear out the fact that although a grounded 300-volt system may be dangerous to a few, it is not dangerous to the human race as a whole, and why should we subject all our patrons to a danger of high voltage from unknown and unforeseen sources for the sake of protecting the few who are born with or develop weak hearts? There is no proof whatever that such people would not be killed when receiving shocks at a potential below 150 volts, which we now say it is good practice to ground.

In twenty years' electrical work in New Jersey, there are but three recorded cases of death from secondary voltage, one at 50, one at 115 and one at 230 volts. There is positively nothing to show that the man who was killed at 230 volts would not have been killed by a fifty-volt shock. In the second case, the man was killed by 115 volts, and in that particular case the secondary system was grounded, which is our accepted practice, according to the ruling of our last convention, and the ground lead in this case showed a resistance of 54 ohms at 115 volts. During nearly four years experience in Connecticut on a 33,000-volt transmission system, we had eight men come at different times in direct contact with the 33,000-volt circuits, and although temporarily disabled and badly burned, every one of these men is to-day alive and working, and these men certainly would not have been affected by the shocks on the secondary system received by the three unfortunate fellows mentioned above. Our personal belief that the Lord makes a very large percentage of His people with sound hearts, and our belief that those unfortunate enough to have weak hearts must have very weak ones to have them affected by a 300-volt electric shock, and our further belief that the danger from accidental contact between secondary and high potential systems is much greater than from grounded systems of 300 volts, leads us to the final conclusion that the grounding of secondary systems up to a pressure of 300 volts is the only humane method of electric distribution.

Where to Ground.—It has been generally conceded that there are but three satisfactory points at which a secondary system may be grounded, namely: at the generating station, at the transformers, and at the customer's premises. If the ground is at the station it means that there will be a ground wire run on the poles throughout the system, thereby causing an unnecessary hazard to linemen working on the lines. Moreover, if this single ground wire should become broken, which is not at all unlikely, the entire system will thereby lose its ground connection, which makes this point of grounding less desirable than either of the other two available points. The grounding at the transformer by means of running a wire immediately down the pole on which the transformer is placed, and grounding it at the nearest suitable point, is a fairly safe method, but has its limitations, due to the fact that under this system there will be very many cases where a suitable ground will be either impossible, or very impracticable to reach, and again, you are placing your faith in but one ground connection for the secondary system for that particular transformer. The third system, or grounding at the premises of each customer, brings about a multiple grounding system, which should be much more secure than either of the other two, and can have but two points of condemnation, neither of which is very serious; the first being that it brings high potential, at times of cross, right to the building of the customer; and second, that the wiring contractors in some cases object to the installing of such a ground wire, claiming that it should be the business of the company which puts up the service loops, although all the companies with which I have acquaintance, which ground in this way, consider it the wiring man's part of the work and insist upon it.

The benefits of a multiple ground are much greater than the benefits of a single ground, and lead us to believe that the third method is much the best of the three.

How to Ground.—There are three accepted methods of grounding; an active water supply system, a buried copper plate and a driven metal pipe or series of pipes. Results of resistance measurements on all three types, 105 in all, were submitted by the speaker. The average resistance of the water-pipe ground was 14.6 ohms, that of the ground-plate was 8.5 times as much, or 126 ohms, and that of the driven pipe was 9.3 times as much, or 136 ohms. It was noted that 51.4 per cent of the plate grounds exceeded 100 ohms, the highest one found being 519 ohms. Of the driven-pipe grounds, the lowest resistance found was 63 ohms, while the highest was 272 ohms. A ground resistance exceeding five ohms is hardly desirable. Such an average is not an easy thing for an operating company to maintain, although the tests which we have made, show that 57.2 per cent of the water-pipe grounds come within this class, and that 1.85 per cent of the ground-plate grounds come within this limit, while none of the driven-pipe grounds can qualify. At the present time, in the State of New Jersey, there is no great amount of attention paid to the inspection of ground wires, nor has there been any periodic inspection of them. A more rigid system, which is now going into effect, will, without question, bring about a higher percentage of good grounds, namely, five ohms or less. A study of the tests given seems to show clearly that a water-pipe ground can be made satisfactory. Probably the grounding to a well-bonded trolley-rail or cable-sheath would be equally as effective, and the ground plate

system is preferable to the driven-pipe system, although there are not a sufficient number of tests on driven pipes in the record given to make it fair to give this as a final conclusion. Information obtained from other sources leads me to believe that driven-pipe grounds can be made more effectual than the ground-plate. Both ground-plate and driven pipe must necessarily be affected to a very considerable extent by the weather, which changes the moisture conditions of the soil in which they are placed. On account of the unreliability of the artificial ground, we are immediately confronted with the problem of what to do where water supply systems are unavailable, or grounding to them is prohibited, and immediately comes up the second question as to the desirability of making mandatory a grounding rule for secondary systems of a certain pressure, and then limiting such a rule to sections where water supply systems can be used for grounding purposes. Yet, if a good ground on a secondary system is a good thing, there may be no harm in making mandatory the rule, with the modification as stated above, for the greater percentage of the patrons of the electrical industry are located where such a method of grounding is possible and it is surely better to protect a large percentage of the people interested, rather than not give any one this known protection. The good results which it seems possible to obtain from plate grounds or driven-pipe grounds in certain localities, leads us to believe that it may be possible to develop a system of grounding which would be a combination of the system having a ground wire run on the pole lines for a considerable distance, and the one which grounds at the customer's premises, and in that way the final desired object of satisfactory grounding could be attained. Good grounding, without question, can be brought about in such sections where water supply is not available, by using the station ground system exclusively, although it might involve considerable expense.

C. W. Stone said that the whole question of grounding secondaries has always been a very interesting one. If it is wise to ground any system at all, we should ground all systems. He agreed with Mr. Osgood that the amount of life risk is not materially increased by reason of the increase in potentials from 150 to 300 volts. It had been his experience that in the majority of cases of injury due to electric shock coming from higher potentials, it was due to crosses between the primary and the secondary system. The question is not entirely one of life hazard, but the fire hazard is increased by not having systems grounded, for the simple reason that so many cases are known to exist of the primary and the secondary systems coming in contact, either by the breakdown of transformers, or the crosses outside of the stations. If the higher potential gets on the secondary system, it is very apparent that it must cause a breakdown somewhere of that secondary system insulation. Perhaps the fuse will blow and clear it, and perhaps it will not. But if the secondary system is grounded the fuse will blow and clear the trouble usually before it has spread very far. The Code Committee of the American Institute of Electrical Engineers last year reported to the Board of Directors, and the Board of Directors voted in favor of grounding all circuits up to and including 300 volts. Later, at another meeting, at which Mr. Blood was present, Mr. Blood dissented from that opinion, and on account of that the general recommendation was withdrawn and was not presented at the joint meeting of the Underwriters. By taking definite action, and recommending that the rule be made mandatory up to and including 150 volts, we will at least land somewhere. In making pipe grounds, several pipes should be used and joined together. The ground around the pipe should be loosened and salt water used. This will maintain a lower resistance.

C. E. Allen said that in connection with the grounding of secondaries, the question of resistance should be taken into consideration. In many cases in the country there was such a high ground resistance that it did not do any good, and in case of a breakdown it would have an effect on the secondary line. If the rules are going to be laid out, they ought to deal with conditions such as will arise where there is some ground resistance.

In closing the discussion W. H. Blood, Jr., said that the more he studied the subject the less he felt that he knew about it. The difference in practice and in opinion is startling. There are so many conditions to be taken into consideration that it is almost impossible to come to any conclusion. With the figures given in the report you can come to almost any conclusion that you see fit. The committee were unanimous in the report and thought it wise to keep their recommendation down to the definite one of grounding, making mandatory the grounding up to and including 150 volts. It may be all right to go beyond that, but the only thing the committee could do was to play safe. Mr. Osgood's argument that because the man had been killed at 300 volts he would be killed at 150, was hardly well taken. While the committee were deliberating on this matter, one of the committee, in his own bathroom, received a shock of 150 volts, which knocked him completely over, knocked him insensible, and he said he felt sure that if it had been 300 volts it would have killed him, because he got just about all he wanted with 150 volts. The speaker agreed with Mr. Stone fully in his statement that the grounding of the systems would reduce the number of fires or would tend to do so. The whole secret of successful grounding is to get a good ground; it is the imperfect ground that does the damage. Some of the references indicate that pipes three-eighths inch in diameter were used. They are perfectly useless. The pipe should not be less than an inch in diameter, and preferably an inch and a half, and driven as far down in the ground as possible—twenty-five feet is not any too much. It is better to drive several pipes down, and they should be near together.

Presents Testing Plant to University of Illinois.

Upon the recommendation of Robert Quayle, superintendent of motive power and machinery, and with the approval of W. A. Gardner, general manager, the locomotive testing plant of the Chicago & North Western Railway Company has been presented to the University of Illinois. Under the immediate direction of H. T. Bentley, assistant superintendent of motive power and machinery, it has been taken from its foundation, the bearings and other running parts have been put in good order for service, and the plant with all the special patterns used in its construction has been loaded and shipped to the University of Illinois. It is understood that the plant will be held by the University pending the construction of its proposed transportation laboratory.

It is announced by Dean Goss of the College of Engineering that the plant at the University will constitute a portion of the equipment of the School of Railway Engineering and Administration, and that when installed it will be operated under the immediate direction of Prof. Edward C. Schmidt.

Postal to Try Printing Telegraph.

The Postal Telegraph-Cable Company will soon make an extensive trial of the Morkrum printing telegraph on the lines between New York and Boston. This system is entirely electrical, none of the operations being mechanical in the ordinary sense. It is designed for duplex working.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

ALTERNATING-CURRENT INDUSTRIAL POWER-PLANT SWITCHBOARDS.—II.

BY WARREN H. MILLER.[1]

In Fig. 5 is seen a railway two-phase board handling main generator currents of about 1,500 amperes. The generator panels have Westinghouse Type F ammeters, a frequency meter for each machine, quick-break field switch, rheostat handles and main switches for the two phases. The third panel is for combined output of the two, carrying the voltmeters, indicating wattmeter, synchroscope and lamps, and two-phase, three-wire main switch. Adjoining it is the exciter panel with Weston instruments, an ammeter for each exciter, voltmeter with switches for paralleling, rheostat handles, main switches and two-pole circuit breakers. The main switches follow the usual practice of having the third leg for the equalizer lead, the exciters being always compound-wound. Breakers are a good feature for exciters over fifty kilowatts, as, when such an important machine gets a bad "short," or burns out a commutator lead, it cannot be gotten off the load too quickly, even though the whole power house may have to come down with it. The next panel is for the lighting generator, condensed so as to include exciter instruments, and the other two are four-wire and three-wire light distribution systems. The integrating wattmeters on the bottom panels are the Westinghouse round switchboard type mentioned before. The ammeters and voltmeters at the top of the panels are Westinghouse Type F, aggregating in cost about $400, and would hardly seem to warrant that expenditure on currents as small as the switches would indicate.

The large nineteen-panel board shown in Fig. 6 was mentioned at the beginning of this article. It controls four 700-kilovolt-ampere, three-phase, twenty-five-cycle, General Electric alternators, direct-connected to 825-horsepower, 23.5 by 32.0 inch Bethlehem Steel Company's horizontal, double-acting, four-cycle, side-crank gas engines, operating at 167 revolutions a minute; also two 300-kilovolt-ampere Westinghouse alternators, direct-connected to Forbes fourteen by thirty-eight by sixteen-inch compound vertical marine engines; also one 62.5-kilowatt Westinghouse steam-driven direct-current exciter, direct-connected to a thirteen by twelve-inch Harrisburg side-crank engine, running at 275 revolutions a minute; and one sixty-five-kilowatt, 110-horsepower, Westinghouse, 480 to 110-volt, motor-generator. Of the ten feeder panels, seven control and meter the power circuits, of about 600 amperes per leg, for various departments; two control 480-volt, three-phase light circuits, which are stepped down at central points and split up into three 110-volt, two-wire distribution systems; and one panel controls three 200-kilowatt, 480 to 2,300-volt, step-up transformers for a high-tension circuit feeding an acid plant, pumping station, and steamer-loading equipment at the water front a mile away.

Specification of generator panels would be as follows:

Top section, twenty inches by thirty-two inches.
- One 1,200-ampere, three-pole, Cutter "Dalite" circuit-breaker.

Middle section, fifty inches by thirty-two inches.
- Two lamp brackets.
- Three 1,200-ampere, Weston, alternating-current ammeters, 480 volts.
- One Weston 200-ampere, direct-current, 110-volt ammeter.

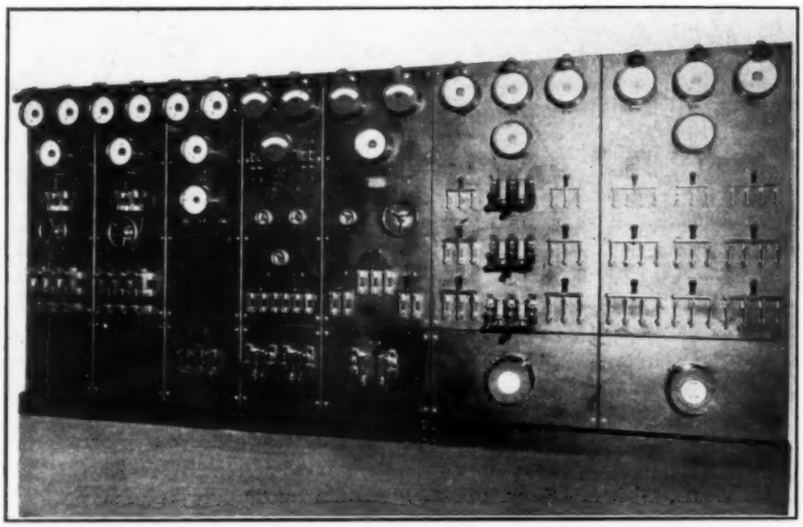


FIG. 5.—RAILWAY AND LIGHTING ALTERNATING-CURRENT BOARD.

- One 1,200-kilowatt, Westinghouse, integrating wattmeter, three-phase.
- One 200-ampere, direct-current, quick-break, field switch.
- Synchronizer and voltmeter plugs and lamp.
- Alternator field rheostat handle.
- One Walker 1,000-ampere, three-pole, double-throw, main switch.

Bottom panel, twenty inches by thirty-two inches.
- One Westinghouse, 1,000,000-kilowatt-hour, polyphase, ironclad, integrating wattmeter.

The large breaker at the top of the panel is put there because when bad runs of gas or very light loads occur, there is always considerable misfiring and backfiring among the gas-driven generators. If one engine lets go, its load is immediately thrown on to the others, and one of them is almost sure to backfire also. Meanwhile the first

[1] Electrical Engineer, Standard Oil Company.

engine's governor will have opened wide, and it gets a tremendous charge of gas, out of all proportion to the load, so it speeds up, thereby closing the governor again, and also tries to "motor" all the other engines and take the whole load itself. This slows it down again, if it does not also cause a second backfire, and as the other engine is undergoing a similar cycle of irregularities, "hunting" starts up in the power house. Heavy squirrel-cage dampers on the generator field-poles, and prompt non-overtraveling governors will minimize the hunting, but, on the board it is necessary to fuse the main generator connections so as to have *some* protection in case an engine gets too wild. Fuses have the disadvantage of being apt to blow when the engines might have quieted down, so in this board the writer determined to try time-limit circuit-breakers, which can be set to blow after twenty seconds of surging, exceeding fifty per cent overload of the generator current. The "Dalite" is a mechanical time-limit feature, having no complicated electrical relays whatever, and is very simple and compact. It depends on the adhesion of two flat disks immersed in oil, which varies as the amount of surface of the disks in contact, the viscosity of the oil being a constant. By making the disks segmental, the amount of surface in contact can be varied at will by simply turning one of them.

The double-throw main switch is another gas-engine feature. It is almost essential to have an emergency bus with all mixed large engines, particularly if some of them are gas engines. Often one of them will be unable to carry its share of the load in parallel, and yet pull all of it if alone on a separate bus. Again it may be so balky from some temporary defect in ignition, or packing, or piston rings, that it disturbs the whole power house, and yet one can get five or six hundred kilowatts out of it, if alone by itself. So the departmental circuits are arranged in two sets of three each, feeding off large double-throw switches on two of the feeder panels. This switch connects either of them on to main or emergency buses, and so gets a good load for the balky engine.

All the other meters have been described before, except that ammeters of this size are always run from the small 1500/5-ampere current transformers, and so are not restricted as to their location on the panel.

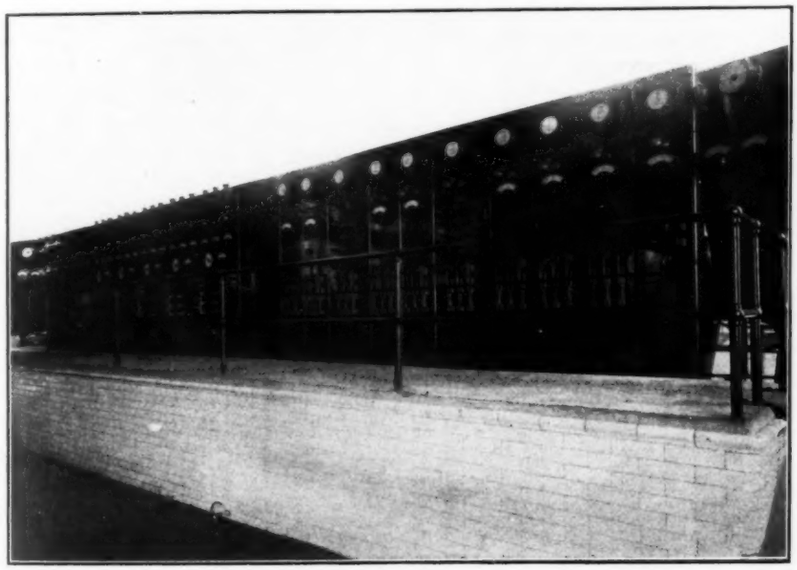


FIG. 6.—ALTERNATING-CURRENT POWER AND LIGHT BOARD.

The standard feeder panel specification is:

Top section, twenty inches by sixteen inches.
- One Westinghouse, three-phase, 1,000,000-kilowatt-hour, round, switchboard-type, integrating wattmeter.

Middle section, fifty inches by sixteen inches.
- One lamp bracket.
- One 600-ampere, Weston, alternating-current ammeter.
- Power-factor meter switches.
- One three-pole single-throw, 600-ampere, Walker knife-switch.
- Three 600-ampere, N. E. Code, knife fuses.

Bottom section, twenty inches by sixteen inches.
- Blank.

On two special twenty-four-inch panels the ammeter is replaced by a 2,000-ampere, three-pole, double-throw knife switch, which effects the main or emergency bus connections to the sixteen-inch panels on each side of it, including its own panel current of 600 amperes.

A new feature of these panels is the power-factor meter, shown at the right-hand end of the board. It is well worth while to be able to read the power-factor of any one feeder at will, for that is what one really wants to know about the works power-factor. It enables one to keep up the load percentage high all over the works, and remedy matters whenever any falling off is shown by the meter. To get the instrument to read on any panel, the two small plug switches shown on each panel are all that are needed. The power-factor meter requires current and voltage from one leg of the feeder only. A common current-transformer main takes care of one side of the current circuit, passing in series through one leg of all the current switches. The other leg connects to the second current main when the switch is pulled out as far as it will go. At the same time the voltage plug is put in on the same panel, connecting in this feeder to the voltage side of the power-factor meter.

Of the three-station panels, one controls the 62.5-kilowatt, 110-volt, steam exciter, and the 65-kilowatt motor-generator exciter. It has 600-ampere, double-pole circuit breakers on the top panel, an ammeter for each, and a common voltmeter with two-point switch, rheostat handles and main switches, on the middle panel. The equalizer is single pole, as one exciter is used to charge the works electric storage-battery locomotives, while the other is exciting generators, and, as the charging voltage reaches 140 volts at the end of charge, they must have no possible equalizer connection except when both are exciting in parallel or transferring. The second station panel has a Westinghouse, single-phase, twenty-five-cycle, frequency meter on the top section; ground detector, one six-point and one two-point, round, copper, detector and synchronizer switches, and a Tirrill regulator, on the middle section. The frequency meter is the handiest instrument on the whole board, and should never be omitted in boards of any size, because

it tells at a glance the speed of the power house, and shows instantly just how much the change is when some large load or other goes on outside, without having to rush around for a tachometer or revolution counter. The Tirrill regulator saves the men constantly running up on the switchboard platform to adjust the voltage, as loads come and go, and should always be on large boards.

The third station panel controls and meters the purely auxiliary power house apparatus, such as gas-engine, jacket-water centrifugal pumps, etc. It also handles two direct-current circuits for charging electric storage-battery locomotives from one exciter, and gas-engine igniter current from the other.

All boards around this size should be at least eight feet from the wall, and the smallest should not be less than three feet from the wall. They should never be set in front of blank spaces unless there is plenty of side light, as the back of the board is always dangerous, no matter what the voltage, principally because of the tendency of the buses instantaneously to burn up screwdrivers, monkey wrenches and other metallic substances which are handled carelessly. Unfortunately this includes also the men holding them, so there should always be plenty of light back of the board, and the writer also specifies all buses taped and shellaced for the further safety of the electricians.

Finally, never have the switchboard company erect and connect up your board for you. Do it yourself, and then you will know something about the ins and outs of that particular board, and will not have to spend half a day hunting up the switchboard man, or digging it up out of the prints when something fails to operate with no apparent reason therefor, as is always the case when the electrical equipment gives trouble.

The Choice of a Prime Mover.

In a recent paper concerning the choice between steam turbines and piston engines for power in mill plants F. W. Dean says that there is no doubt that where electricity is to be used the turbine should be chosen. It is fully equal, if not superior, in economy to the piston engine. It requires less room, less foundation, less oil, the wear is almost nothing, and the fact that oil is not used in the steam renders it practicable to use condensed steam for feed water. This is of great advantage in bad water districts, and means freedom from boiler difficulties, and the absence of water purification devices.

The turbine does not lend itself to belt driving, and in cases where electricity is not desirable the piston engine will hold its place. Such cases are mills where nearly all of the machinery operates simultaneously, as in textile mills, and in which there is an opportunity for simple direct drives by belts or ropes. In this case the cost of installation and of fuel is less than by any other combination. Where there are tools or machines that operate intermittently the electric system is advisable, and direct current is to be preferred to alternating current on account of the absence of power-factor troubles. In many cases, however, it is not practicable to use direct current on account of the length of transmission. In some machine shops the power-factor is as low as sixty per cent, which means that the generator will give only sixty per cent of the power that it would give if the power-factor was 100 per cent.

In regard to the reliability of turbines, the author referred to a 500-kilowatt turbine that has run twenty-four hours per day without stopping for eleven months. It was stopped for general examination and showed no sign of wear, nine cents were spent for repairs, and it was then started again. It then ran fourteen months, twenty-four hours per day, without stopping, and is now stopped for connection with a new switchboard. It will be examined, but the only known defect is slight leakage of a valve. Another turbine in the same building has made one run of three or four months and one of one month, both without stopping. It has not been used as much as the other because the other kept going.

In very large central power stations nothing but turbines should be given the slightest consideration.

The historic city of Coventry, England, has recently completed a refuse destructor, at a cost of $125,000, for generating steam for the municipal electricity station. The ash will be utilized for manufacturing concrete slabs.

Waterpower Development in Sweden.

Consul-General E. D. Winslow, of Stockholm, reports that the water power of Sweden is estimated to be able to furnish 10,000,000 horsepower if properly handled. This energy can be made available for at least nine months of the year. Of the great falls of the Kingdom seventy-five per cent are in Norrland. The Government wishes to get in working order as much of the power as possible. The State at present owns 277 falls. The largest fall now managed by the State is Trollhättan, whose energy is expected to produce 80,000 turbine horsepower, but at present is only producing half that force. At the Porjis Falls, in northern Sweden, 50,000 turbine horsepower is expected to be realized.

Japanese Waterpower Plan.

A new policy has been adopted in Japan in connection with the multitude of concessions for hydroelectric plants. For some years there has been a mania for obtaining these franchises, and applications were granted for almost every Japanese river on which a town of 50,000 was situated.

Many of the concessionaries proved to be speculators without any idea of carrying on the work. The Tokio Government now has instructed local officials that a time must be fixed within which these concessionaries must get to work or forfeit their rights.

To Inventory Michigan Power Plants.

Prof. M. E. Cooley, of the University of Michigan, and an assistant recently conferred with the State Railway Commission relative to an appraisal of the properties of the waterpower concerns which have asked the commission's authority to issue bonds to a large amount. Professor Cooley will inventory each plant and place a value upon it for the information of the commission in passing upon the bond applications.

House-Wiring Campaign in Marion, Ind.

The Marion Light and Heating Company, Marion, Ind., has secured many new customers as a result of its widely advertised co-operative plan by which it was made known that during the month of June any contractor in the city would wire houses at the low rate of $2.00 a room, including cord drop and socket.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

Novel Lighting Effect at the Brussels Exposition.

Among the many beautiful buildings at the international exposition now being held at Brussels, the German Building stands pre-eminent as a fine example of architectural achievement. It was designed by Professor von Seidl, of Munich. Its strikingly original appearance by day attracts the attention of all visitors and even from a distance it elicits favorable comment. It was considered highly desirable, therefore, to render the building equally conspicuous by night, and, in keeping with its style, it was illuminated in a novel manner. The success of its external lighting is evident from the general admiration that it has evoked.

To produce an original lighting effect, it was decided to depart from the common methods of outline lighting and to install a system of so-called soffit lighting. This was carried out by placing rows of twenty-five and fifty candlepower lamps in the cornices so that they were hid from direct view and threw their light down on the front and sides of the building. The effectiveness of this scheme was enhanced by the white color of the walls. Auxiliary outline lighting was provided by rows of two-candlepower lamps. The accompanying illustration gives but an inadequate idea of the striking beauty of the entire effect. The dark roofs and columns are strongly contrasted by the bright wall surfaces. The outlines of the building are sharply marked. Bright strings of small incandescents follow the edges of the roof of the central clock tower. As a whole, this lighting scheme is a brilliant example of modern illuminating engineering.

In the installation there are 700 incandescent lamps of fifty candlepower and 800 of twenty-five candlepower hidden in the cornices; these are 110-volt lamps, placed two in series. There are also 2,000 two-candlepower, fourteen-volt lamps for the outlining; these are connected in sets of sixteen in series across the 220-volt mains. The installation was designed and completed by the Allgemeine Elektricitäts Gesellschaft, of Berlin.

The Illumination of Interiors.

Three lectures on the above subject were delivered at the East London College (University of London) on Wednesdays, June 8th, 15th, and 22d, respectively. The first two, by Prof. J. T. Morris, dealt with (1) "Principles and Daylight Illumination," (2) "Artificial Illumination by Gas and Electricity;" the third, by Prof. C. A. M. Smith, was devoted to "Illumination by Petrol Air-Gas." The following brief abstracts of the first two lectures are from *The Illuminating Engineer*, London:

THE GERMAN BUILDING AT THE BRUSSELS EXPOSITION.

In opening the first lecture Professor Morris remarked upon the importance of having lights situated so that the direct rays could not enter the eye. This was demonstrated by some simple but instructive experiments.

After discussing some of the incorrect methods of illumination caused by people's lack of knowledge of the subject, the lecturer proceeded to point out some interesting facts in connection with daylight and its variations. Observations taken in the grounds of the East London College on June 7th (an average bright day) showed that at 1:30 p. m. the intensity of illumination was approximately 3,500 candle-feet. On the sun becoming obscured for a short time the intensity dropped to less than one-third of this value, while at 6:30 p. m. it was only 170 candle-feet. By 9 o'clock the intensity was not much more than 1-20,000th of the mid-day value. When the arc lights were turned on the value rose to 0.1 candle-foot.

Turning next to the relation between the illumination inside a room and the intensity of illumination outside, Prof. Morris mentioned as a remarkable fact that only about one-hundredth to one-thousandth of the outside intensity found its way into the average room. In this connection the lecturer exhibited a table, compiled by P. J. Waldram, showing the value of this ratio in the case of several well-known build-

ings throughout London. For example: On desks in a new elementary school, 0.0025 to .008; ordinary offices, average 0.001; House of Lords, 0.006; Charing Cross Station, booking hall, 0.0001 to 0.0003. It is interesting to observe that this ratio remains fairly constant throughout the day, and is, seemingly, more or less independent of climatic conditions.

It will thus be seen that there are wide fluctuations continually taking place in the light of which we are more or less unconscious. In explanation of this the lecturer explained how the pupil of the eye expands and contracts with variation in intensity of incident light. This point was illustrated by curves showing the result of tests made at the East London College. These curves illustrated the connection between the area of the pupil aperture and the illumination; a very sharp bend in the curve occurs when the illumination is reduced to a certain value below one foot-candle. The effect of light entering the eye obliquely was also shown.

Most of the experiments on intensity were made with a Trotter universal photometer equipped with the special daylight attachment. The principles and action of this instrument were explained by the lecturer. He also pointed out how much there remained to be learned on this subject, although a marked impetus to researches in this field had been given by the formation of the Illuminating Engineering Society. When the society was first founded, he confessed that he had been among those who were not altogether convinced as to its utility; but he had since come to appreciate the importance of its impartial attitude and the work it proposed to carry out, and he was now thoroughly convinced of the useful field before it.

In his second lecture Professor Morris continued his discussion of the measurement of daylight illumination. Referring to the arrangement for measuring the ratio between the interior and outside unrestricted sky-illumination, he pointed out that the brightness at different parts of the sky varied considerably. This difference could be very readily studied by the aid of the Trotter daylight attachment, and Professor Morris exhibited a table illustrating the manner in which the intensity varied from the zenith to the horizon. In using the Trotter daylight apparatus the result obtained must, therefore, be regarded as to some extent arbitrary, though, as stated above, the ratio connecting the indoor illumination with the unrestricted sky-illumination outside did remain very constant in spite of fluctuations in climatic conditions. Attempts had been made to ascertain the ratio of intensity at the zenith to the average intensity; it appeared to be about five to one.

Turning next to artificial illumination the lecturer pointed out one fundamental distinction between gas and electric lighting, namely, that whereas the nature of the electric current was quite definite, the quality of gas supplied varied in different localities. In testing a Keith high-pressure burner a difference of over fifty per cent in the candlepower was obtained between measurements made in East London and North London. It is, therefore, particularly important that steps should be taken to see that consumers get a definite calorific value.

The leading systems of electric lighting were also briey touched upon and some comparative figures given for different types of lamps. The Moore vacuum-tube lamp was specially noticed owing to its exceptionally low intrinsic brilliancy. Figures were given showing the intrinsic brilliancy of various sources. A few examples are: Sun, 10,000 candlepower per square centimeter; arc, 16,000; tungsten lamp, 150; carbon filament, 16; high-pressure gas, 25 candlepower per square centimeter.

In passing, the lecturer remarked that he, personally, was not concerned exclusively with the advantages of any one method of lighting, and desired to examine each one on its merits and to preserve an entirely unbiased and judicial attitude.

A series of remarkable curves, which had been obtained from measurements taken by the lecturer, were then presented, showing the fluctuation of light on the leading electric railways and tramways of London. On "the Circle" a variation between about 0.8 candle-foot and over two candle-feet was noticed. A comfortable reading illumination in trains is one candle-foot. The advantages of metallic-filament lamps on variable voltage supply was well illustrated in one case in which both these and carbon lamps were used on the same railway. As was to be expected, the variations on trams were much more marked.

The lecturer next turned his attention to shades and reflectors, and exhibited some scientifically designed shades. Professor Morris also expressed a strong opinion that street lamps should always be so shaded that the source of light could not be seen. He characterized the lighting of Whitehall as magnificent as regards intensity of illumination, but faulty from the standpoint of excessive glare.

The lecturer also remarked that there was a general impression that for interior lighting the nearer the lamp the better the illumination. The fallacy of this was well exemplified by curves showing the intensity of illumination over a floor with an arc lamp at two different heights. Lowering the lamp actually decreased the light where it was most required.

Testing the Steadiness of Sources of Light.

Although frequent reference is made to the steadiness of various sources of light, comparisons must always remain a matter of conjecture unless we have some means of actually testing the variation in candlepower.

In this connection some experiments of E. Presser, are of interest, says *The Illuminating Engineer*, of London. This investigator has pointed out that although the selenium cell is too uncertain in action to be used for absolute light measurements, it can, nevertheless be effectually applied for comparative measurements of the light from one and the same source. Some physical test of this kind would seem to be needed, for the light from some lamps fluctuates so rapidly that it would be difficult to obtain a photometric measurement before the conditions had changed.

In Presser's method the changes in resistance of a selenium cell, due to fluctuations in the light impigning upon it, are recorded on a moving drum, and the behavior of different kinds of arc-lamps and gaslamps can be readily compared in this way.

Electrically produced ozone is used in Germany for purifying the drinking water of the cities of Berlin, Paderborn and Wiesbaden.

FACTORY LIGHTING.[1]

BY C. E. CLEWELL.[2]

The general requirements for factory lighting besides sufficiency and continuity are: uniformity, a general illumination making the use of individual carbon lamps unnecessary except in special cases, the absence of glare, and a type of lamp adaptable to the conditions of the work over which the system is to be used.

The most approved method of securing these results is by means of the so-called overhead illumination system, in which lamps are placed high enough to be out of the range of vision, and of a sufficient number to furnish illumination practically independent of the position of the work. The older method and an alternative scheme is to provide a moderate intensity by means of an overhead lighting system, supplemented by the use of individual carbon lamps placed close to the work of each employee.

Consideration of eye strain and economy of operation point to the superiority of the first-named system, in which no drop lamps are used except in special cases. Until recent years the high-candlepower arc lamp and the low-candlepower carbon-filament lamp were the only available units for factory service. This limitation in the size of units often necessitated the use of drop lamps, specially in those cases where the ceiling or mounting height was such as to be too low for the use of arc lamps to advantage, and too high for the use of carbon-filament lamps as an overhead illuminant. In such cases the only available scheme was the use of the carbon lamp placed close to the work. The advent of the Nernst, Cooper Hewitt, and tungsten lamps, with candlepowers lying between those of the arc and carbon-filament lamp, has done much to broaden the possibilities of factory lighting by furnishing units of sizes adapted to certain conditions which heretofore have not satisfactorily been met by either the arc or carbon-filament lamp.

Under the details of illumination design, the working drawing to be of the most value to the average wireman should be as simple as possible, should contain the outline of the floor space together with the designation of the light units in a clear and distinctive form located to scale. This drawing should contain the dimensions of the floor space together with the spacing distance between lamps. Specifications on such a drawing will include the number and type of lamp, type of glassware or shades, mounting height, and switching control.

A matter of much importance in the details of lighting design is the choice of the number of light units for a given floor space to be lighted. The attitude in approaching a lighting problem is often "this is the size and style of units to be used, how many will be required," but should rather be "how many units will be required to furnish a uniform light sufficiently low in shadow effect," this then to be followed by the choice of the size and type of unit, which, when properly arranged, will furnish light of sufficient intensity.

A further item under lighting design details is the mounting height of lamps in factories, which will often be limited by the details of the building construction and interference of cranes. In general all units should be mounted where possible high enough to be out of the range of vision. The glare due to the light from an intense lamp striking the eye is harmful, economically speaking, because it reduces the sensitiveness of the eye, thus causing the intensity on the work, possibly otherwise ample, to appear insufficient. The glare is likewise harmful physically speaking, and it is axiomatic that a man to be of the most value as a workman should be surrounded by the most advantageous conditions for promoting such value.

The lighting circuits are of importance to the designing engineer. Some units are best adapted to direct current, others work to the best advantage with certain frequencies of alternating current, and all lighting units to be most effective should be supplied with a voltage practically constant in value. The question of the lighting circuits should therefore be given careful study by the lighting engineer before the lamps are chosen or installed.

Switch control is a factor in the economy of operation. In practice it will usually be found advisable to install a reasonably large number of switches for each installation, this cost usually being low compared to the energy saved by the ability to turn off the lights in certain sections when not needed. Where possible, lamps should always be controlled in rows or groups parallel to the windows or skylights. It will often be found that lamps are needed at points somewhat removed from the windows at times when the daylight is still sufficient in the proximity of the windows.

Proper and systematic maintenance is a matter of foremost importance in the operation of factory lighting systems. No lighting system, however well installed, will continue to furnish good results unless maintained with the same care which attended its original installation. Where the size of the factory warrants it, a maintenance department should exist. Daily inspection of the lighting systems throughout the factory should be made and regular reports furnished the maintenance department showing how many and where lamps are burned out, or out of service, such lamps to be renewed or repaired at once, thus insuring a high standard of operating service. All reflectors, shades, globes, whether of glassware or metal, should be cleaned regularly and with care. Probably no greater cause for depreciation of lighting efficiency results than from the accumulation of dust or dirt on reflecting or shielding glassware or metal.

The question of cost and value of light is one of much importance to both salesman and consumer. Often an apparently expensive lighting installation will be found to be cheapest in the end, due to its superiority. If one kind of light has a marked advantage over another, its use will result in better or more work, fewer delays and in greater general satisfaction.

1 Abstract of paper presented at a recent meeting of the Pittsburg Electric Boosters Club, May 27, 1910.

2 Engineer with the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

Street Illumination in Great Falls.

The business district of Great Falls, Mont., will be illuminated by twenty-seven five-light tungsten cluster posts. The posts will be of ornamental design, similar to those used at the present time in Minneapolis on Nicolett Avenue. Nine of the posts will be placed on Central Avenue and the remaining eighteen on the side streets, as proposed by City Engineer Allen.

TELEGRAPHY—TELEPHONY, and WIRELESS.

The Telephone Ouster Suit in Kansas.

In connection with the Kansas telephone ouster suit, instituted by Attorney General Fred S. Jackson, of Kansas, to oust the Missouri & Kansas Telephone Company from the state of Kansas, and previously reported in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of July 16 last, page 133, Hon. J. W. Gleed, of Topeka, Kansas, attorney of the Missouri & Kansas Telephone Company, has issued a statement from which the following is abstracted:

"Upon the urgent request of nearly every business man in Wichita, the Missouri and Kansas Telephone Company purchased for cash its rival company in the city of Wichita. Before this purchase was made or agreed upon, I went to Attorney General Jackson and stated the case to him precisely as it was. I stated to him that the consolidation was requested by the business community of Wichita and that the owners of the Independent Telephone Company found it difficult or impossible to procure the money with which to rebuild their plant. Mr. Jackson looked the matter all over. We discussed the statutes and decisions at length, and he decided that the purchase was perfectly legal, and stated to me, 'Go ahead, it is all right.' In reliance upon this opinion of the Attorney General the purchase at Wichita was made. Afterwards a purchase at Hutchinson was made; the conditions there were exactly the same. In speaking to me some weeks ago, Mr. Jackson admitted that no telephone user in the state had made any complaint, and that the only complaint made to him at all had been made by some independent telephone promoters who were rivals in business. It is asked that we be ousted from the state and the field left to a monopoly in the hands of the independent combine, because we have purchased two properties, and the attorney general is erroneously informed that we are about to purchase another."

Attorney General Jackson is reported as not denying the statements of Mr. Gleed, but adds that subsequently he had come to the conclusion that the Missouri & Kansas Telephone Company was making the purchases to destroy competition—hence the ouster suit.

The suit is based upon the recent purchase by the Missouri & Kansas Telephone Company of the independent telephone plants in Wichita and Hutchinson and upon the alleged intent to buy other property.

Time Signals by Wireless Telegraphy.

The Paris Observatory utilizes the excellent antenna of the military wireless station in the Eiffel Tower for regularly transmitting signals at midnight, which permit vessels at sea to regulate their chronometers. The process of operation is as follows: A quarter of an hour before midnight all transmission ceases and a connection is established between the Observatory and the wireless apparatus of the Eiffel Tower. One minute before midnight the transmitting station of the Observatory sends out a series of dashes, which are intended as preliminary signals to attract attention. These signals operate relays at the Eiffel Tower, which in turn cause oscillations to be generated in the antenna. Then the signals are discontinued and exactly at midnight a clock at the observatory closes the relay circuit during one-tenth of a second. Four or five sparks thus pass and send out dot signals which may be perceived within a radius of 3,000 kilometers. In case this signal should not have been received, its transmission is repeated at two minutes after midnight; this is preceded by signals composed of one dash and two dots. And again at four minutes after midnight another time signal is sent out after being announced by preliminary signals of a dash and four dots. The radius of action will shortly be increased to 5,400 kilometers. The wireless station in the Eiffel Tower was damaged by the flood last January and has only lately been put in operation again. The antenna is the highest in the world and will permit the making of interesting investigations. The work is carried on under the direction of Commandant Ferrié, who is already widely known through his remarkable labors in this field.—*Translated and Abstracted from L'Industrie Electrique, Paris, June 10.*

Depreciation of Telephone Equipment.

At the joint convention of the Indiana and Michigan Independent Telephone Associations that was held at South Bend, Ind., E. L. Cline read an interesting paper on the depreciation of telephone equipment. In this he presented a schedule of average depreciation which attracted considerable attention and is therefore given below:

Equipment.	Years Life.	Per cent Depreciation.	Per cent Salvage Value.
Conduit	Unknown	1.0	0
Underground cable	25	2.4	40
Underground lateral	20	3.0	40
Aerial cable	15	4.0	40
Poles, cedar, 25 ft.	10	9.0	10
Poles, cedar, 30 ft.	12	7.08	15
Poles, cedar, 35 ft.	15	5.33	20
Poles, cedar, 40 ft.	17	4.7	20
Poles, cedar, 45 ft.	19	4.21	20
Poles, cedar, 50 ft.	19	4.21	20
Poles, chestnut, 25 ft.	8	11.25	10
Poles, chestnut, 30 ft.	10	8.5	15
Poles, chestnut, 35 ft.	12	6.7	20
Poles, chestnut, 40 ft.	13	6.1	20
Poles, chestnut, 45 ft.	15	5.3	20
Poles, chestnut, 50 ft.	15	5.3	20
Cross arms	8	12.5	0
Copper wire	15	2.0	70
Iron wire	10	10.0	0
Cable terminals	12	8.33	0
Telephones	10	9.0	10
Switchboard	10	8.0	20
Private branch exchanges	10	8.0	20
Buildings	50	2.0	0
Insulators	15	3.33	50
Insulated wire (iron)	12	7.5	10
Insulated wire (copper)	12	6.6	20
Messenger	12	8.3	0
Telephone instruments	10	7.0	30
Booths	10	8.0	20

Railroad Telegraphers' Wages.

Railroad telegraphers have secured forty-eight new and revised wage schedules, aggregating an eight-per-cent increase for the past six months.

Through the Argentine minister in Caracas arrangements have been made for transmitting Venezuelan news happenings to the press of Argentina by cable via London.

The History of the Telephone.

The Development of the Telephone Exchange—II.

BY HERBERT N. CASSON.

When the first baby exchange, for telephone service, was born in Boston, in 1877, it was the tiny offspring of a burglar-alarm business operated by a young man named E. T. Holmes. Holmes, whose father had originated the idea of protecting property by electric wires in 1858, was the first practical man who dared to offer telephone service for sale. He had obtained two telephones, numbers six and seven, the first five having gone to the junk-heap; and he attached these to a wire in his burglar-alarm office. For two weeks his business friends played with the telephones, like boys with a fascinating toy; then six of them agreed to pay $3 a month for regular telephone service. Holmes therefore nailed up a new shelf in his office, and on this shelf placed six box-telephones in a row. These could be switched into connection with the burglar-alarm wires, and any two of the six wires could be joined by a wire cord. Nothing could have been simpler, but it was the arrival of a new idea in the business world.

E. T. HOLMES.

The Holmes' exchange was on the top floor of a little building, and in almost every other city the first exchange was as near the roof as possible, partly to save rent and partly because most of the wires were strung on roof-tops. As the telephone itself had been born in a cellar, so the exchange was born in a garret. Usually, too, each exchange was an offshoot of some other wire-using business. It was a medley of makeshifts. Almost every part of its outfit had been made for other uses. In Chicago all calls came in to one boy, who bawled them up a speaking-tube to the operators. In another city a boy received the calls, wrote them on white alleys, and rolled them to the boys at the switchboard. There was no number system. Everyone was called by name. Even as late as 1880, when New York boasted 1,500 telephones, names were still in use. And as the first telephones were used both as transmitters and receivers, there was usually posted up a rule that was highly important—"DON'T TALK WITH YOUR EAR OR LISTEN WITH YOUR MOUTH."

To describe one of those early telephone exchanges in the silence of a printed page, is a wholly impossible thing. Nothing but a language of noise could convey the proper impression. An editor who visited the Chicago exchange in 1879 said of it: "The racket is almost deafening. Boys are rushing madly hither and thither, while others are putting in or taking out pegs from a central framework as if they were lunatics engaged in a game of fox and geese." In the same year E. J. Hall wrote from Buffalo that his exchange with twelve boys had become "a perfect Bedlam." By the clumsy methods of those days, from two to six boys were needed to handle each call. And as there was usually more or less of a cat-and-dog squabble between the boys and the public, with everyone yelling at the top of his voice, it may be imagined that a telephone exchange was a loud and frantic place.

Boys, as operators, proved to be most complete and consistent failures. Their sins of omission and commission would fill a book. What with whittling the switchboards, swearing at subscribers, playing tricks with the wires and roaring on all occasions like young bulls of Bashan, the boys in the first exchange did their full share in adding to the troubles of the business. Nothing could be done with them. They were immune to all schemes of discipline. Like the Mysterious Noises, they could not be controlled, and by general consent they were abolished. In place of the noisy and obstreperous boy came the docile soft-voiced girl.

If ever the rush of women into the business world was an unmixed blessing, it was when the boys of the telephone exchanges were replaced by girls. Here at its best was shown the influence of the feminine touch. The quiet voice, pitched high, the deft fingers, the patient courtesy and attentiveness—these qualities were precisely what the gentle telephone required in its attendants. Girls were easier to train. They did not waste time in retaliatory conversation. They were less careless. And they were much more likely to give "the soft answer that turneth away wrath."

A telephone call under the boy regime meant Bedlam and five minutes: afterwards, under the girl regime, it meant silence and twenty seconds. Instead of the incessant tangle and tumult, there came a new species of exchange—a quiet, tense place, in which several score of young ladies sit and answer the language of the switchboard lights. Now and then, not often, the signal lamps flash too quickly for these expert phonistes. During the panic of 1907 there was one mad hour when almost every telephone in the Wall Street region was being rung up by some desperate speculator. The switchboards were ablaze with lights. A few girls lost their heads. One fainted and was carried to the rest-room. But the others flung the flying shuttles of talk until, in a single exchange, 15,000 conversations had been made possible in sixty minutes. There are always girls in reserve for such explosive occasions, and when the hands of any operator are seen to tremble, and she has a warning red spot on each cheek, she is taken off and given a recess until she recovers her poise.

In 1902 the New York Telephone Company started a school—the first of its kind in the world—for the education of these telephone girls. This school is hidden amidst ranges of skyscrapers, but 17,000 girls discover it in the course of the year. It is a most particular and exclusive school. It accepts fewer than 2,000 of these girls, and rejects over 15,000. Not more than one girl in every eight can measure up to its standards; and it cheerfully refuses as many students in a year as would make three Yales and Harvards.

This school is unique, too, in the fact that it charges no fees, pays every student $5 a week, and then provides her with a job when she graduates. But it demands that every girl shall be in good health, quick-handed, clear-voiced, and with a certain poise and alertness of manner. Presence of mind, which, in Herbert Spencer's opinion, ought to be taught in every university, is in various ways drilled into the temperament of the telephone girl. She is also taught the knack of concentration, so that she may carry the switchboard situation in her head, as a chess-player carries in his head the arrangement of the chessmen. And she is much more welcome at this strange school if she is young and has never worked in other trades, where less speed and vigilance are required.

No matter how many millions of dollars may be spent upon cables and switchboards, the quality of telephone service depends upon the girl at the exchange end of the wire. It is she who meets the public at every point. She is the dispatcher of all the talk-trains. She is the ruler of the wire highways; and she is expected to give every passenger-voice an instantaneous express to its destination. More is demanded from her than from any other servant of the public. Her clients refuse to stand in line and quietly wait their turn, as they are quite willing to do in stores and theaters and barber-shops and railway stations and everywhere else. They do not see her at work and they do not know what her work is. They do not notice that she answers a call in an average time of three and a half seconds. They are in a hurry, or they would not be at the telephone; and each second is a minute long. Any delay is a direct personal affront. It makes a vivid impression upon their minds. And they are not apt to remember that most of the delays and the blunders are being made, not by the expert girls, but by the careless people who persist in calling wrong numbers and in ignoring the niceties of telephone etiquette.

The truth about the American telephone girl is that she has become so highly efficient that we now expect her to be a paragon of perfection. To give the young lady her due, we must acknowledge that she has done more than any other person to introduce courtesy into the business world. She has done most to abolish the old-time roughness and vulgarity. She has made big business to run more smoothly than little business did half a century ago. She has shown us how to take the friction out of conversation, and taught us refinements of politeness which were rare even among the Beau Brummels of pre-telephonic days. Who, for instance, until the arrival of the telephone girl, appreciated the difference between, "Who are you?" and "Who is this?" Or who else has so impressed upon us the value of the rising inflection, as a gentler habit of speech? This propaganda of politeness has gone so far that today the man who is profane or abusive at the telephone is cut off from the use of it. He is cast out as unfit for a telephone-using community.

So, as we have seen, the telephone as Bell invented it, was merely a brilliant beginning in the development of the art of telephony. It was an elfin birth—an elusive and delicate sprite that had to be nurtured into maturity. It was like a soul, for which a body had to be created; and no one knew how to make such a body. Had it been born in some less energetic country, it might have remained feeble and undeveloped; but not in the United States. Here in one year it had become famous, and in three years it had become rich. Bell's invincible patent was soon buttressed by hundreds of others. An open-door policy was adopted to invention. Change followed change, to such a degree that the experts of 1880 would be lost today in the mazes of a telephone exchange.

The art of the telephone engineer has in thirty years grown from the most crude and clumsy of experiments into an exact and comprehensive profession. As Carty has aptly said: "At first we invariably approached every problem from the wrong end. If we had been told to load a herd of cattle on a steamer, our method would have been to hire a Hagenbeck to train the cattle for a couple of years, so that they would know enough to walk aboard of the ship when he gave the signal; but today, if we had to ship cattle, we would know enough to make a greased chute and slide them on board in a jiffy."

The telephone world has now its own standards and ideals. It has a language of its own—a telephonese that is quite unintelligible to outsiders. It has as many separate branches of study as medicine or law. There are few men, half a dozen at most, who can now be said to have a general knowledge of telephony. And no matter how wise a telephone expert may be, he can never reach perfection, because of the amazing variety of things that touch or concern his profession.

To sum up this development of the art of telephony—to present a bird's-eye view—it may be divided into four periods:

(1.) EXPERIMENT. 1876 to 1886. This was the period of invention, in which there were no experts and no authorities. Telephonic apparatus consisted of makeshifts and adaptations. It was the period of iron wire, imperfect transmitters, grounded circuits, boy operators, peg switchboards and unprofitable rates.

(2.) DEVELOPMENT. 1886 to 1896. Here amateurs had become engineers. The proper type of apparatus had been discovered and was improved to a high point of efficiency. In this period came the multiple switchboard, copper wire, girl operators, underground cables, metallic circuit, common battery and the long-distance lines.

(3.) EXPANSION. 1896 to 1906. This was the era of big business. It was an autumn period, in which the telephone men and the public began to reap the fruits of twenty years of investment and hard work. It was the period of the message rate, the pay station, the farm line and the private branch exchange.

(4.) CONSOLIDATION. 1906——. With the success of the Pupin coil, there came a larger life for the telephone. It became less local and more national. It began to link together its scattered parts. It discouraged the waste and anarchy of duplication. It taught its older but smaller brother, the telegraph, to co-operate. It put itself more closely in touch with the will of the public. And it is now pushing ahead, along the two roads of standardization and efficiency, toward its ideal of one universal telephone system for the whole nation. The keyboard of the telephone development of today is this—CONSOLIDATION.

[EDITOR'S NOTE.—This is the fourth part of a series of telephone articles by Mr. Casson on the History of the Telephone. Chapter II of "The Development of the Telephone Exchange" will be followed by articles on "The Telephone in Foreign Countries" and "Litigation Over the Telephone," each in two parts.]

The Influence of High-Tension Currents on Telegraph and Telephone Installations.[1]

The remedies adopted at first to do away with the troubles due to parasitic currents were: better rail connections and the elimination of the ground connection in telephone installations.

Recently in Switzerland the parasitic currents in railroad signal lines were quite well compensated by the introduction of cells connected in opposition to the potential difference tending to produce them. This, while of perfect application to a constant voltage system (as the Thury) is of no value for a variable voltage one, and for the last quite good results were obtained by carefully made electric connections or by the stringing of a return wire on the low current installations. But the introduction of alternating current for traction work, and the fact that the same troubles which have been noticed in three-phase installations, such as the Valtellina Railway, seem to be present in single-phase systems, require that new solutions of the problem shall be worked out.

From a discussion held by the American Institute of Electrical Engineers it appears that the remedies which have been up to now put forth, namely: (1) The increase in line impedance; (2) the shunting of the receiving apparatus by means of condensers; (3) magnetic screening by metallic wire coils, etc.; have more or less shown their inefficiency, and that in the future it may become necessary, for long distance work, to place all the telegraph lines in armored cables (the armor being grounded) and to have each telegraph circuit made up of two twisted wires.

It may be of interest to give a summary of the new rules recently issued by the Prussian State Railroad Department on the building of high-tension lines using the railroad right of way.

An installation permit must be obtained and a yearly tax paid. The standards adopted by the German Society of Electrical Engineers must be followed. Lines shall not interfere with railroad operation, they must be constructed to avoid any accident to man or material and must be installed, repaired or dismantled without causing interruption of service. Overhead transmission is only allowed for alternating current systems. Any other system must use armored cables, placed as far as practicable from the rails, at not less than 3.5 feet from the surface, covered with slate and their position to be shown by stone posts. At crossings they must follow tunnels or bridges and if crossing under the tracks they must be put in special masonry or concrete conduits.

The administration inspectors control the work; the erecting company is not on that account relieved from responsibility, it being liable for the cost of any transformation or improvement rendered necessary on the government low-current lines. The service from the high-tension line must be immediately stopped if there is any indication of induction trouble or of danger to telegraph and telephone lines. For the overhead lines: Conductors must be at least seven meters from the ground, about two meters lower than and 1.25 meters on the side of the telegraph line; protecting nets must be used if a multiple system of suspension is not; supports to have solid foundations, etc. Soldering of the wires is prohibited; crossing points to be as small in number as possible; section breakers of easy action and easily reached to be placed each side of a crossing. Low-current lines to be equipped by the contractor with protecting nets, guard wires, etc., to avoid any danger of high-tension, and any inductive effect to be eliminated. We will now report the perturbations, causes and remedies tried and adopted on the single-phase line from Seebach to Wettingen in Switzerland. The transmission voltage is 15,000, and the high-tension line (eight-millimeter copper) and the telephone wire (three-millimeter iron) run parallel for a distance of twenty kilometers. The distance between conductors varies from 2.52 to 7.5 meters with an average of 4.8 meters.

As soon as the first section of the high-tension line was opened, trouble was noticed in the form of vibrations of the printing key in the receiving apparatus. The frequency of these vibrations corresponded to the pulsations of the high-tension current.

The first engine used on the line was equipped with a converter transforming the fifty-cycle single-phase current to direct-current, but in a short time another engine using fifteen cycles was put in its place. This change, while influencing enormously the telephone installation did not influence at all the telegraph line.

That the disturbance was due to electrostatic influence and not to dynamic induction or parasitic currents was proven by the following:

(1) The voltage readings at the static voltmeter and the current readings for the static charge.

(2) The vibrations started as soon as the high-tension line was connected up.

(3) The vibrations were not influenced by the presence of a train on the line.

(4) They were more frequent on open circuit (when one end of the line was insulated).

To insure the service, a second telegraph line was strung and the apparatus was connected in series and equally divided between the two wires, which were once transposed between each two stations.

With the cutting-in of a new section of the high-voltage line the vibrations started again, stronger than ever.

At first an insulation fault was looked for, but finally the real reason was found to be in the capacity of a 4.6 kilometer cable between Oerlikon and Zürich.

Under those conditions the remedy was found in connecting the telegraph apparatus in parallel. To do that the resistance coils were changed from 15,000 turns and 500 ohms to 30,000 turns and 10,000 ohms.

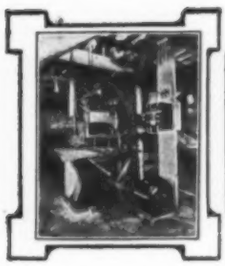
This system of connection allows of an easy discharge of the line, either by condensers or by grounding the neutral. This second method seems to be the best, as the condensers do not stand the atmospheric discharges.

No more disturbances appeared and this method may be very useful in the future on other installations.

[1] Translated and abstracted from *L'Industrie Electrique* for April and May, 1910.

City May Own Telephone Plant.

The City Council of Willmar, Minn., has passed an ordinance authorizing the city to build and own a local telephone exchange, means to be provided by an issue of "telephone certificates" in the sum of $35,000. The ordinance will have to be ratified by the voters at a special election, says the *Municipal Journal and Engineer*.



Industrial Power

The Action of the X-Ray in Large and Small Doses.

Since the discovery of the X-rays and their application to therapeutics, many and various results have been obtained from their use, results often quite contradictory in character, the explanations of which have at times been distinctly puzzling. It has been difficult in many instances to explain why in one case the use of the rays would cause degeneration and at others regeneration of similar tissues; why, for example, in one patient superfluous hair would be removed and in another the use of the rays on a smooth skin would result in a profuse hirsute adornment. In recent years, however, means have been devised of regulating the dose of the X-rays and of estimating in units the amount of radiation being administered in each case. This has made the study of the action more accurate and has enabled the illumination of several obscure points. In the *Berliner klinische Wochenschrift* for May 23, 1910, H. E. Schmidt reports a small series of experiments into the effect of various doses of the X-ray upon cell growth. Having soaked a number of beans in water for six hours he treated the different beans with different doses of the rays, and then planted them. His results were quite uniform and demonstrated two points of interest. Whereas those beans which were treated with large doses of the rays were partially or completely inhibited in their growth, as compared to untreated control beans, those which received very small doses were distinctly stimulated; not only were the plants larger and more vigorous, but the flowers were larger and the resulting crop of beans better. From these findings Schmidt suggests that the same principle may apply to animal cells, and experiments which he carried out on an ulcer on the arm suggested that this is the case. If this be so, it is evident that in treating conditions in which healing is desired, as a sluggish ulcer, very small doses of the X-ray should be used, whereas in cases of malignant growth, where tissue destruction is required, large doses are needed, and small doses instead of destroying the neoplasm may do harm rather than good by stimulating it to renewed activity.

Theater Engineering in Canada.

The construction of a modern theater of the first rank is of sufficiently rare occurrence in Canada as to be worthy of some notice on the part of engineers, says A. C. Oxley, in *The Canadian Engineer*.

The Shea theater now nearing completion on Victoria Street, in Toronto, is perhaps the most recent example.

Steam is supplied by an Inglis multitubular boiler of 100 horsepower, operating at low pressure. All portions of the building are heated by direct radiation, except the auditorium. For it two positive 100-inch fans with a capacity of 40,000 cubic feet per minute are used, driven by a twenty-horsepower motor, causing the fresh air to be driven past some 6,000 feet of steam-heated coils. In addition to the positive heating plant abundant circulation is maintained by the use of suction ducts in all portions of the building, the induced draft being caused by three motor-driven exhaust fans, with a total capacity of 55,000 feet per minute; one in the basement and two located above the ceiling. The plant is guaranteed to maintain a temperature of seventy degrees Fahrenheit in a temperature of —20 without straining or vibration. In order to assure safety the boiler is placed under the sidewalk, a substantial brick wall intervening between it and the stage dressing-rooms.

In addition to the footlights the stage is lighted from above by rows of movable lights hung from the trusses. For the moving pictures and spotlights, a permanent fireproof cabinet is installed with its own air exhaust duct. All wires throughout the building are incased in pipes chased in the walls.

A New Form of Motor.

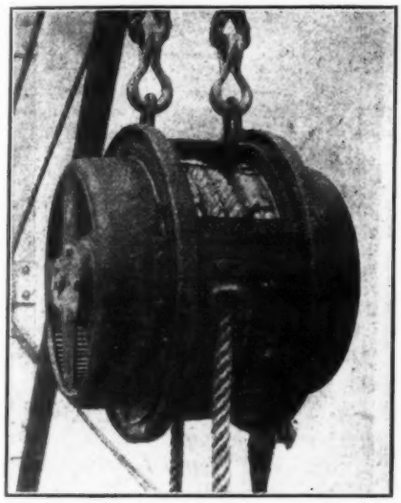
A new type of three-phase motor has been put on the market in England which has no brushes, slip rings, rotor cables or outside starter. The features of the machine are the method of fixing the resistances to the rotor, and the arrangement for cutting them out while the machine goes up in speed at starting. When the machine works at full speed there are no rubbing contacts whatever. A very important feature of the machine is that, being started through a large number of steps—from twenty to thirty per phase—there is no jumping of the current at starting, it gradually varying by small steps from the starting to the running value. The revolving resistances are entirely inclosed in a cast-iron case, and are cut out either by hand or automatically. The automatic type, considering the simplicity of its construction, is an important step forward in the development of induction motors. A long-distance control is thus accomplished at very little expense and with the most reliable means, by the simple operation of closing the stator main switch. It is claimed that the current can be kept practically constant while the machine is speeding up, thus accomplishing what many complicated devices, in the case of hand control, are supposed to do. G.

L. Wicher, of Warsaw, Poland, is looking for the addresses of manufacturers of electric melting apparatus for the melting of platinum in charges of one-quarter, one-half and one kilogram. The current available is three-phase, 120 volts, fifty cycles. Information is wanted with respect to the consumption of current, time required for melting the specified charges, as well as the net and gross weight, the dimensions, and the prices of the packing.

A New Method of Coaling Vessels.

A so-called power pulley, an electric hoist of special construction, capable of raising loads up to 120 kilograms with a speed of two meters a second, has recently come into extensive use for the purpose of coaling vessels. The power pulley manufactured by the Siemens-Schuckert Works is driven by an electric motor, on the magnet frame of which the pulley is directly mounted. The magnet frame carries a toothed ring and is geared to the casing of the power drum by means of an intermediate cogwheel. The hoisting rope is carried along by friction, and it has been found by experiment that one and one-half turns around the drum are entirely sufficient to prevent its slipping. The motor is started by a simple rheostat.

A special arrangement is provided



ELECTRIC POWER PULLEY.

for lowering the rope after a load has been removed from the hook attached to it; namely, the drum of the power pulley is not rigidly attached to the magnet frame, but is connected to it by means of a friction coupling, which is automatically released when the load is removed, and the rope is then carried downward by the weight of the hook.

The standard size of the power pulley is capable of raising a load of thirty tons an hour to a height of seven meters.—*Translated and Abstracted from Elektrotechnischer Anzeiger (Berlin), May 22.*

Electric Elevators on New Ships.

The new White Star liners *Olympic* and *Titanic* will include on each ship three first-class-passenger electric elevators.

Inspection and Testing of Materials.

At the meeting of the London Society of Engineers on June 6 a paper was presented by C. W. V. Biggs on "The Inspection and Testing of Engineering Materials and Machinery." The author dwelt upon the advantages of standardization in both manufacturing and testing. Usually specifications contain one or two clauses which cannot reasonably be made to apply, or not without excessive cost. The aim of the engineer is to obtain a certain article for the money and of the contractor to supply an article which shall have a ready sale. Both require tests, which are sometimes duplications. It is very difficult to compile a series of tests applicable to different branches of work without including requirements which, while necessary in some cases, become superfluous and vexatious in others. It is, however, desirable that specifications should be as closely detailed as possible. Many accessories which would be satisfactory under one set of conditions, may become a lively source of complaint under another, yet these can hardly be provided for within the limits of a specification of reasonable size. The specification is generally limited to pointing out the requirements for each class of machinery, and the inspector must satisfy himself that the articles supplied do or do not attain to the standard set from the evidence of performance tests.

To maintain a certain standard, leading contractors have a testing department. From the purchaser's point of view a test is a species of invitation to the machine to break down, if it has a breakdown in its composition, at the maker's works, in preference to doing so afterwards at his own. As experience and the collection and study of evidence on the matter indicate weak points, these are eliminated, and, consequently, in the case of machines which have been in use for some time, the chance of breakdowns becomes less and less. There must, however, be an average rate of breakdown, altering from year to year by slow degrees; this may be called "reasonable risk." From statistics gathered by one of the leading machinery insurance companies, a reasonable risk appears to be (taking the average over the four years 1905 to 1908) one in 9.4 for steam engines. Gas engines, as being more immature, may reduce their reasonable risk figures in the course of a few years; at present they are 1 in 10.9. Dynamos work out at 1 in 14.8, and motors, with all the ill-treatment they receive, register only 1 in 8.8. In each case about one-quarter of the breakdowns registered are classified as due to "weakness, faulty design, and workmanship," and the same proportion to "old defects and wear." The thorough testing of these machines before they leave the works should eliminate a considerable proportion of the risk of "faulty design and workmanship" as well as "old defects."

It is through the details that trouble may crop up, and the checking of these is one of the most important of the inspector's duties. Material of comparatively small value, such as lighting fittings and tramway overhead parts, on account of the careful checking required, and the danger of repeat work being rushed through, often costs in inspection an amount quite disproportionate to the value.

The author then discussed the specifications and tests for structural steelwork, bolts, boilers, valves, piping, condensers, steam engines, storage batteries, machine tools, railway fittings, cranes and galvanizing, as well as the following.

Electric generators depend upon insulation and rigid construction. The design of dynamo or motor may well be left to the contractor. Brush gear should be looked into, and a sectional drawing of the commutator may be required. The machined parts of all castings should be examined. This particularly applies to rotor spiders, which are frequently faulty. The works may be left to take permeability and hysteresis tests of iron for armature, rotor, and stator stampings. With good modern silicon steels any trouble due to heating is far more likely to be due to the designer having cut his iron too low or to "burring" of the plates during erection than to the intrinsic properties of the material itself. The built-up stators of large motors and generators should be examined before winding commences, particularly in the case of machine with partially inclosed slots.

After making sure that the insulation is thoroughly satisfactory and of sufficient thickness, and that the coils are being carefully wound and not mal-

treated, the inspector has little further to do on small machines until they come up for final test.

For all large electric high-tension polyphase generators where form-wound coils are used, each coil should be tested at three or four times the working pressure before issue to the erectors. It is instructive also to take one coil per one hundred and actually break it down. The machine is run six hours at full load (if an alternator, preferably at 0.80 power factor), and the final temperature of the hottest part taken.

Heating tests are of importance. Each motor should be tested, as it is no uncommon thing for five out of six motors to come within specified temperature limits and the sixth to exceed. As regards rating, crane motors should be reckoned on the result of one hour's run on full load. Continuous rating is reckoned by the Engineering Standards Committee as six hours' run at full load, with a maximum permissible temperature rise of forty degrees centigrade. Or to save time such motors may be tested for four hours only, the first two at twenty per cent to twenty-five per cent overload, and the remainder at full load. This has roughly the same effect. The efficiency is also usually specified. It is a good check to plot the open-circuit and external characteristic curves from particulars taken on test. This should be done for one or two motors out of a large order to check against curves supplied by the makers, and ascertain that no important variation has taken place since these were issued.

At the termination of a six-hour test, motors and dynamos are usually "flashed," that is, they have a pressure three times the rated working pressure passed through the windings for one minute, while still warm, with a view to locating any weak points which may exist.

On all alternators the no-load excitation curve and short circuit characteristic need to be taken. It is advantageous also on alternators having open-slot stator stampings to obtain the sine wave by an oscillograph or by an ondograph.

The tests for electric underground cables are amongst those which have been standardized by the Engineering Standards Committee. Paper insulated cables should have the paper occasionally tested for tensile strength and be submitted to microscopical examination to insure absence of adulteration of the wood pulp. Vulcanized india-rubber cables should be tested in core stage. For cables critical tests on completion are those of copper resistance, insulation resistance, and pressure test, as per the Engineering Standards specification for polyphase work. Paper cables for polyphase work should be tested for capacity.

Switchwork is liable to one main defect, that the copper or brass screw passing through the board, to which a cable has been connected on the other side, is likely to be too small. It is then impossible to tighten up the lug of a heavy cable sufficiently well to make good contact without risk of screwing off the end of the connection. Small cables, which are fairly flexible, do not put this stress on the connections. The sectional area allowed for the rubbing contact of switches is generally ample, and if there is going to be any trouble with these it will be at the joints. Fuse boxes only need testing when designed for use on high tension circuits; otherwise inspection for workmanship will suffice. In dealing with switchboards it is usual to connect all the current-carrying parts of the switches, etc., to one pole of a high-tension testing circuit, and the framework of the board to the other pole; this will bring out any weak point in the insulation.

On high-tension switchboards the carriers and back connections for the cables consist of or necessitate the use of porcelain insulators. While the porcelain insulators used for telephone and telegraph work call only for an examination as to glazing, and a red ink test as to porosity, the porcelain insulators used for high-tension transmission lines and high-tension switchgear are very important items. The author is indebted to J. F. C. Snell for permission to quote his specification, which requires that all insulators should pass the following test:

"The insulators to be made from the best hard-fired English porcelain, thoroughly vitrified and non-hygroscopic. The glaze to be continuous throughout. Each insulator to be uniform, acid and alkali proof, and delivered and erected free from all flaws, cracks, bubbles and chipped edge. Any faulty insulator to be rejected. The corrugations (or internal threads, if any) in the insulators to be uniform and cleanly molded. Sample insulators, taken at random from a batch, to be broken into small pieces, and accurately weighed after being kept in a dry oven for twenty-four hours. The pieces to be then immersed in water for twenty-four hours, and after being carefully wiped to be again weighed. If the samples show any increase of weight through absorption, the consignment from which they are taken to be rejected. Each insulator to be immersed in water for forty-eight hours, the surface dried, and subjected to a test pressure of three times its working pressure for one hour without breaking down. Each insulator to be subjected to a mechanical test by applying a weight to the extremity of the insulator when fixed at its base or on its pin, so as to give a side strain of at least four times the normal load it is required to carry."

Meters and measuring instruments are checked against standards at various points of the scale, or, in the case of wattmeters, are run for a certain time at stated loads. The accuracy of these meters is very apt to be questioned, and, therefore, in the case of large quantities, the standards themselves have to be checked up occasionally. The insulation of power-station meters, including their transformers, must be carefully watched. Cables used in the power house should be fireproof, the fireproof qualities being tested from samples taken at the works. The switch panels are of marble or slate. Marble and slate must be examined for metallic veins. These are difficult to locate without cutting into the slabs (which is impracticable). The slabs should therefore be soaked and tested with an ohmmeter across the doubtful parts. The chambers for high-tension apparatus are made of fireproof brickwork or some form of cement work. Pieces of this should be tested in an electric arc to see if it disintegrates.

If his work is to be done in a thorough manner, the inspector must maintain a number of standard instruments for the purpose of checking the calibration of those available at the factory. A millivoltmeter with shunts and multipliers, an alternating-current voltmeter and ammeter, instrument transformers and wattmeter are desirable.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

AMERICAN TELEPHONE.

The American Telephone & Telegraph Company and associated holding and operating companies, not including connecting independent or sub-license companies, report for the month of May and five months ended May 31, 1910, with all duplications, including interest, dividends and other payments to the American Telephone & Telegraph Company excluded, compared as follows:

	1910	1909
May gross	$13,504,386	$12,179,288
Expenses and taxes	5,073,407	4,547,878
Balance	8,430,979	7,631,410
Maintenance and depreciation	4,498,652	3,744,517
May net	3,932,327	3,886,893
Interest	1,014,186	829,080
May surplus	2,918,141	3,057,813
Five months' gross	66,831,950	59,822,702
Expenses and taxes	24,746,815	22,571,493
Balance	42,085,135	37,251,209
Maintenance and depreciation	21,745,550	18,247,693
Five months' net	20,339,585	19,003,516
Interest	4,571,732	4,786,996
Five months' surplus	15,767,853	14,216,520

The unexpected portion of the provision made for depreciation for the first five months of 1910 was $8,580,934, which is not counted as profits, but remains as a reserve for future replacements.

Earnings of the American Telephone & Telegraph Company for six months ended June 30, compare as follows:

	1910	1909
Dividends	$ 9,202,326	$ 7,123,915
Interest other revenue	5,651,492	5,154,523
Telephone traffic	2,565,227	2,089,129
Real Estate	49,742	49,491
Other sources	127,106	795,771
Total	17,595,895	15,212,832
Expense	1,694,485	1,226,953
Net	15,901,410	13,985,879
Interest	2,586,355	3,892,629
Balance	13,315,054	10,093,255
Dividends	10,352,353	7,631,291
Balance	2,962,701	2,461,693

AURORA, ELGIN & CHICAGO.

The report of the Aurora, Elgin & Chicago Railroad Company for the month of May and eleven months ended May 31, compares as follows:

	1910	1909
May gross	$ 142,644	$ 133,029
Expenses	82,338	71,356
May net	60,306	61,673
Eleven months' gross	1,444,026	1,316,430
Charges and taxes	33,662	28,549
May surplus	26,644	33,123
Eleven months' surplus	294,901	282,840
Expenses	809,097	724,795
Charges and taxes	340,928	308,794
Eleven months' net	635,829	591,635

MEXICAN LIGHT AND POWER.

The Mexican Light and Power Company reports as follows for the year ended December 31, 1909:

Gross income	$3,014,025	Inc.	$75,851
Net income	1,888,090	Inc.	30,186
Deductions:			
Bond Int. M. L. & P.	594,375	Dec.	5,625
Bond Int. M. E. L. Co.	293,287	Dec.	6,713
Sinking Fund M. L. & P.	118,875	Inc.	8,875
Sinking Fund M. E. L. Co.	58,657	Dec.	1,343
Common dividends	543,400	Inc.	67,925
Preferred Dividends	168,000	Inc.	48,373
Total deductions	1,776,594	Inc.	111,492
Surplus	111,496	Dec.	81,305

KINGS COUNTY ELECTRIC.

The report of the Kings County Electric Light and Power Company, for the month of June and six months ended June 30, 1910, compares as follows:

	1910	1909
June gross	$ 352,906	$ 304,270
Expenses	172,712	149,036
June net	180.194	155,234
Charged to depreciation	103.672	87,810
June surplus	76,522	67,424
Six months gross	2,107,060	1,840,996
Expenses	997,112	874,736
Six months net	1,109,948	966,260
Charged to depreciation	610,698	526,070
Six months surplus	499,250	440,190

AMERICAN LIGHT AND TRACTION.

The report of the American Light and Traction Company for the month of June and six months ended June 30, 1910, compares as follows:

	1910	1909	1908
June gross	$286,209	$238,171	$189,835
Expenses	12,047	9,649	4,000
June net	274,161	228,522	185,835
Six months gross	1,800,031	1,546,980	1,217,426
Expenses	57,677	53,787	24,000
Six months net	1,742,354	1,493,192	1,193,426

NIAGARA, LOCKPORT & ONTARIO.

The report of the Niagara, Lockport & Ontario Power Company for the month of June compares as follows:

	1910	1909
June gross	$45,526	$32.922
Expenses and mortgage	18,262	16,433
June net	27,264	16,489
Other income	1,409	1,454
Total income	28,674	17,943
Interest	20,721	20,832
June deficit	7,953	*2,891

*Deficit.

THIRD AVENUE.

The New York Public Service Commission has issued a report of the lines comprising the Third Avenue Railway system for the quarter ended March 31, which compares as follows:

	1910	1909
Gross	$ 1,871,934	$ 1,628.290
Expenses and taxes	1.305,734	1,247,010
Net	566,200	391.280
Other income	1,202	1,268
Total income	567,492	392.548
Charges	224,572	233.586
Surplus	342,920	158,962

BROOKLYN RAPID TRANSIT.

The New York Public Service Commission has issued a report of the Brooklyn Rapid Transit system for the quarter ended March 31, which compares as follows:

	1910	1909
Gross	$ 4,866.795	$ 4,468,665
Expenses and taxes	3,582,978	3,451,311
Net	1,383.817	1,017,354
Other income	92,886	90.783
Total income	1,476,703	1,108,137
Charges	1,555,515	1,350,245
*Deficit	78,811	242,107

*A deficit is shown of the charges due to the fact that inter-company transactions have not been eliminated.

HUDSON & MANHATTAN.

The New York Public Service Commission has issued a report of the Hudson & Manhattan Railroad Company for the quarter ended March 31, which compares as follows:

	1910	1909
Gross	$ 648.576	$ 211,743
Expenses and taxes	315,110	153,758
Net	333,466	57,985
Other income	230,305	151,708
Total income	563,771	209,693
Charges	562,725	165,184
Surplus	1,046	44,509

DETROIT UNITED.

The report of the Detroit United Railroad Company for the month of May and five months ended May 31, compares as follows:

	1910	1909
May gross	$ 795,380	$ 664,507
Expenses	476,300	389,179
May net	319.050	275,328
Other income	12,196	12,669
Total income	331.276	287,997
Charges and taxes	163,368	154,932
May surplus	167,908	133,065
Five months' gross	3,512,595	2,940.573
Expenses	2,257,789	1,827,533
Five months' net	1,254,806	1,113,040
Other income	61,632	58,907
Total income	1,316,438	1,171,947
Charges and taxes	804,527	769,337
Five months' surplus	511,911	402,610

NORTHERN OHIO TRACTION.

The report of the Northern Ohio Traction and Light Company for the month of May and five months ended May 31 compares as follows:

	1910	1909
May gross	$207,323	$188,749
Expenses	11,250	103,832
May net	96,073	84,917
Charges	43,375	43,809
Surplus	52,698	41,107
Five months' gross	865,662	775,739
Expenses	501,105	445,389
Five months' net	364,557	330,350
Charges	216,541	219,075
Five months' surplus	148,015	111,275

EDISON ELECTRIC ILLUMINATING, BOSTON.

The report of the Edison Electric Illuminating Company of Boston, for the month of June and twelve months ended June 30, compares as follows:

	1910	1909
June gross	$ 354,840	$ 293,885
Expenses	159,797	144,469
June net	195,043	149,416
Twelve months' gross	4,707,599	4,111,343
Expenses	2,107.223	1,770,956
Twelve months' net	2,600,371	2,340 387

INTERBOROUGH RAPID TRANSIT.

The New York Public Service Commission has issued a report of the Interborough Rapid Transit Company (including both divisions) for the quarter ended March 31, which compares as follows:

	1910	1909
Gross	$ 7,605,270	$ 7,039,526
Expenses and taxes	3,270,747	3,127.723
Net	4,334.523	3,911,803
Other income	92.057	257,451
Total income	4,426.581	4,169,254
Charges	2,639,783	2,595 050
Surplus	1,786,798	1,574,204

ONTARIO POWER COMPANY.

The Ontario Power Company, of Niagara Falls, reports earnings for the month of May, compared as follows:

	1910	1909
May gross	$57,968	$16,518
Expenses and taxes	9,893	43,575
May net	48.075	*27,057
Other receipts	6,429	265
Total income	54,504	*26,791
Charges	47,770	26,371
May surplus	6,734	*53,163

*Deficit.

New Electrical and Mechanical Apparatus and Appliances.

Installation of Large Gas Engines.

One of the accompanying photographs shows a train loaded with a single Allis-Chalmers gas engine blowing unit. During the past few months Allis-Chalmers Company has shipped four gas engine generating sets and two gas engine blowing units to the Lake Superior Iron and Steel Corporation at Soo Ste Marie, Canada, and has two more of the blowing units nearing completion. Each one of these units required twelve cars for its transportation and its weight approximated 1,000,000 pounds.

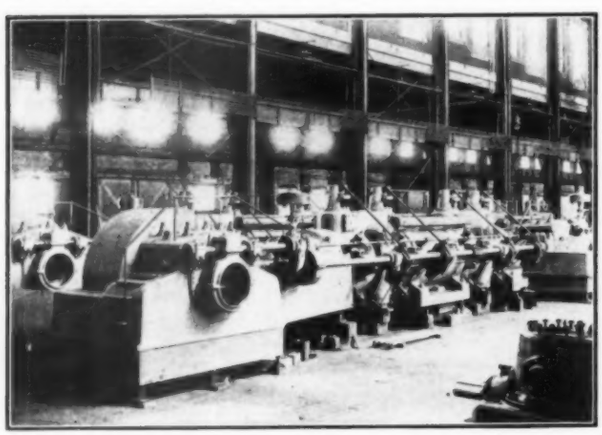
These gas engine units are being installed in a large extension of the Lake Superior Iron and Steel Corporation's plant at Soo Ste. Marie, Ontario, Can. The original rail mill will have a largely increased capacity and new plate and merchant mills will be built as well as coke ovens. Operations will be started at the plant in the near future. For furnishing power for the mills and blowing the furnaces the company purchased the above units from Allis-Chalmers Company. They will be supplied with gas from the blast furnaces.

The gas engines are all alike, being of the twin-tandem four-cylinder type with cylinders thirty-four by forty-eight inches. They conform to the company's standard in all respects. Four of these engines are direct connected to 1,765 kilovolt-ampere twenty-five-cycle, three-phase, 2,300-volt alternators running at 107 revolutions per minute. These sets will supply power for driving the motors about the mill.

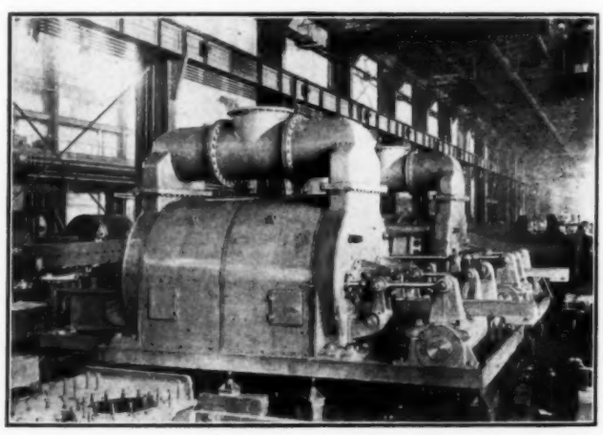
The other four units are to be connected to the new Slick blowing tubs manufactured by Allis-Chalmers Company. These tubs are sixty-four by forty-eight inches and are arranged to operate duplex on the opposite side of the main shaft from the engine. Each blowing unit has a capacity of 25,000 cubic feet per minute when running at seventy-two revolutions per minute, but can be speeded up to eighty-five revolutions per minute if necessary.

When the new works are completed this will be the largest steel producing plant in Canada, and naturally the most modern.

TRAIN LOADED WITH A SINGLE ALLIS-CHALMERS GAS ENGING BLOWING UNIT.



GAS ENGINE ASSEMBLED IN SHOP.



VIEW OF SLICK BLOWING TUBS.

A Ton of Platinum.

It is an interesting fact, perhaps not generally known by operating telephone men, that precious metals, such as platinum, gold and silver, and even precious stones, such as diamonds, are used extensively in the manufacture of telephone apparatus.

The Western Electric Company, the largest manufacturer of telephones in the world, uses upwards of one ton of platinum each year, for contact points of telephone apparatus, etc.

When it is considered that the value of platinum is thirty per cent greater than that of pure gold, it will readily be seen that this expensive precious metal would not be used extensively unless results justify it.

An Electrical Equipment for Wood-Working Plants.

At the present time the reducing of the manufacturing expenses in industrial plants is considered a matter of great importance. In the modern wood-working plant this is especially true, for the reduction of waste and cost of processes in the manufacture of wood-

MACHINING AND DRESSING DEPARMENT—FIRST FLOOR.

en material offset the high cost of raw material and make for a better profit.

The most satisfactory results along these lines in the wood-working plants have been obtained through the improvements of the machinery used and the power equipments used for driving this machinery. These improvements have brought about revisions in processes along purely productive lines.

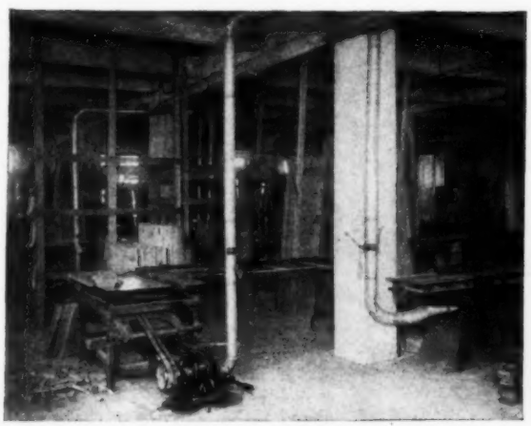
Under the head of power equipment for the wood-working industry, the electric motor has played an important part in increasing the output of machines and reducing the cost of operation per horsepower required by them. This reduction has been, for the most part, made possible by the elimination of the chances for power to be absorbed between its source of generation and application, motors being usually applied direct to the machines, thus doing away with long belts and complicated overhead mechanical transmission such as line shafts and jack shafts. Besides these economies accredited to the electric motor, it has in many cases made possible newer and more efficient designs of wood-working machinery.

With the electrically equipped plant, where motors are applied to individual machines, there is besides the saving in power cost a number of items which tend to produce efficient operation, therefore bringing about a saving which must be credited to the equipment. Some of these items is the reducing to a minimum the depreciation of the transmission system, and the saving in time due to the fact that the machinery is laid out with especial reference to facility in the transfer of material from one machine to another.

Changes in the arrangement of any machinery or additions to any equipment can be made with very little added expense in the way of transmission apparatus. Another important feature in the operation of electrically equipped plants is that any section of machinery can be operated independent of any other section, thus reducing the cost of overtime operations and making possible this extra work, which in most cases affects only a few machines and will with the mechanically operated plant hold up an order on account of the fact that a steam engine under light load does not operate economically.

The actual saving in power cost realized by a system of electric-motor drives over other systems is pretty generally recognized and has been carefully determined in a number of cases by authorities on power transmission. In the average shop using belt and shaft transmission it has been found that the power wasted in friction, belt slippage, turning idle pulleys, etc., amounts to from twenty-five to fifty per cent of the total power used. It can readily be seen, therefore, that the elimination of this waste in a plant where power is extensively used is an important factor.

Other valuable features of an electrically equipped plant are that there is nothing overhead the machines to



SASH AND TRIM DEPARTMENT—SECOND FLOOR.

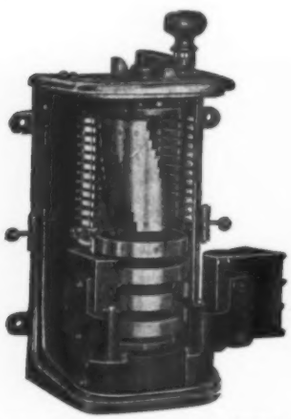
SASH AND WARDROBE DEPARTMENT—THIRD FLOOR.

interfere with the handling of long pieces of wood or to obstruct light and ventilation. Records showing the exact power required by various departments can be obtained and studies made which provide a means of distributing fixed charges and determining the productiveness of each group of apparatus.

The accompanying illustrations are taken from the newly equipped plant of the Murray-Hill Company, New York City. This factory is constructed of reinforced concrete and laid out with especial reference to economy in handling the work. All of the machines are individually driven by Hawthorn induction motors. In the power house is installed one 150-kilowatt and one 350-kilowatt, three-phase, sixty-cycle Hawthorn alternating-current generators of Western Electric manufacture, direct connected to vertical-compound steam engines. These units furnish power for the motors and also furnish energy for the lighting equipment of the factory.

Drum Type Controllers for Machine Tools.

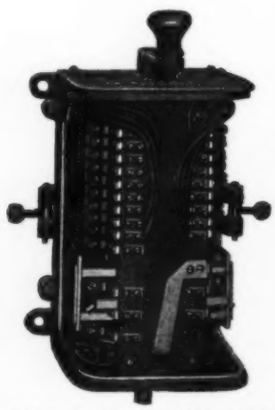
For the control of machine tools driven by electric motors where the starting service is frequent or of a severe nature, drum-type controllers should be used in preference to other types.



GENERAL ELECTRIC DRUM TYPE CONTROLLER.

The General Electric machine-tool controllers shown in the accompanying illustrations have been designed with many special features to meet the conditions of modern shop practice. Among these features may be mentioned substantial removable barriers between the fingers wherever required; magnetic blow-outs for all equipments for 500-volt service or for large currents at lower voltages; special screws to hold the segments with heads slightly counter-sunk below the surface so as to prevent their wearing with the segments, and tapered at such an angle as to prevent their loosening; sheet-iron covers lined with asbestos to protect live parts from dust and mechanical injury, and eliminate the danger of shock from accidental contact; terminals and other parts readily accessible; and field control with adjustable fingers similar in design to the fingers for the armature circuit.

VIEW SHOWING CONTACTS.



ANOTHER VIEW OF CONTROLLER.

When it is desired to obtain overload and no voltage protection in connection with drum controllers, a CR-251 panel should be used. This panel consists of a DP circuit-breaker, a single-pole contactor and two fuses, all mounted on a slate base, the latter being provided with feet to make a neat installation. The circuit-breaker and fuses afford the overload, and the contactor the no-voltage protection. The operation of these panels depends essentially upon an electrical interlock between the no-voltage release and the drum controller. When the controller handle is moved to the first point the coil of the contactor is energized, closing the contactor and completing the armature circuit.

An Ozonizer with a Fan Electrode.

Ozone and the field offered by the possibility of making it by means of electricity for small as well as large users is attracting the attention of central-station men in an increasing degree. One of the most recent of the equipments made for this purpose is that devised by the Standard Electro-Utilities Company, 312 Fifth Avenue, Chicago, which manufactures the "Vohr" electric ozonizer illustrated in Fig. 1. Fig. 2 shows the apparatus employed, with the case removed and without the transformer, which is in practice placed beneath the apparatus shown.

One of the essential features of the device is the use of a small electrically-driven fan as an electrode. This is the second, or inner, fan shown in Fig. 2, where the outer fan is simply a suction-fan to help pull the air through the ozonizer and keep any one from thrusting wires or other articles into the "live" parts. This inner fan is of a peculiar pattern and itself constitutes one electrode of the apparatus for producing the brush discharge. Surrounding it is a ring of glass six inches in diameter and two and one-half inches wide. On the outer surface of this ring, or annulus, is placed a metal band, which is the other electrode of the apparatus. There is an air-gap between the fan-blade electrode and the glass annulus. The air is drawn in at the other end of the case by the suction of

FIG. 1.—VOHR ELECTRIC OZONIZER.

the fans and as it passes through the violet glow of the brush discharge, a portion of the oxygen is converted into ozone and discharged through the screened opening shown in one of the accompanying illustrations.

These machines may be connected either with 110 or 220-volt circuits, and operated on either direct current or alternating current at sixty cycles. If only direct current is available, a specially designed rotary converter is substituted for the alternating-current motor used in the case of an alternating-current source of electricity. The amount of electricity consumed is said to be about the same as that taken by one carbon filament, sixteen candlepower lamp. The device is simple, not apt to get out of order, and requires no cleaning. One great advantage of the Vohr machine is the comparatively light concentration of ozone compared with the large volume of air treated. It circulates a large volume of air mechanically and gives the amount of ozone recommended by leading medical authorities. Another feature to which the manufacturers direct attention is the fact that the period of ozonization is very slight, owing to the instantaneous passage of air between the electrodes.

Ozone has many industrial possibilities, as well as being useful in small quantities in freshening the air in dwelling houses, offices and factories. Its field embraces water purifying and many industrial enterprises, such as

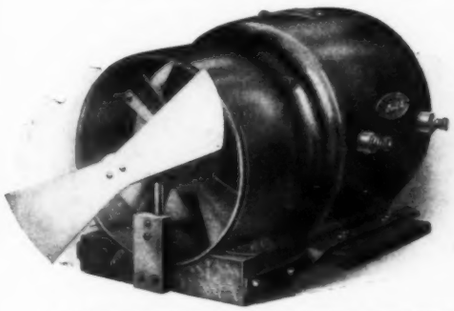


FIG. 2.—OZONIZER WITH COVER REMOVED.

breweries, tanneries, soap factories, laundries, the preserving of fruits and produce, the cyanide process in mining, the aging of whiskey, and a number of others. The subject is one of present-day interest to electrical men, owing to the fact that the increasing use of this product will make necessary corresponding increase in the use of electricity.

The Judd Washing Machine.

The electric washing machine illustrated and described herewith, has been introduced not only as a much needed public convenience but also as a vehicle whereby electric central-station companies may materially increase their day loads and so increase their load

WRINGER IN OPERATION.

factors. As has been frequently pointed out, the selling profit on such current-consuming machines is of secondary consideration compared with the profit on the current which they use and which is almost always utilized during the off-peak hours.

This electric washer, which is manufactured by the Judd Laundry Ma-

JUDD MACHINE WASHING CLOTHES.

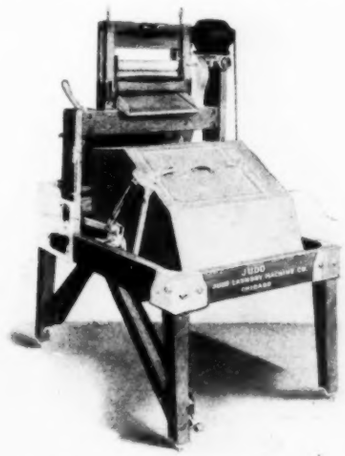
chine Company, 547 West Jackson Boulevard, Chicago, Ill., is the result of much care and experiment in design, and the results both from a practical and artistic standpoint are all that could be desired.

The electric motor has been carefully selected for the duty which devolves on it in this machine, and is capable of taking care of any ordinary sudden and severe overload which may occur in the operation of wringing. It is mounted in such a position as to be out of the way of drippings, and is also out of range of persons operating the machine.

Energy is transmitted by belt to the clothes receptacle. The same motor is used for operating the wringer and the driving mechanism is so arranged that clothes may be wrung while the washer is in operation.

The clothes receptacle is made of hand-rolled copper and brass. It is guaranteed not to shrink, warp, leak or rust and is hygienic and sanitary. The feature of the Judd washer is the manner in which the clothes are cleansed. The receptacle is revolved in semi-circles, at a high rate of speed, this action forcing water, soap and air into, around and through the goods many times a minute. There are no paddles, cylinders, ribs or pegs in the interior of the tub and the most delicate fabric is said to be unharmed after washing.

The Judd washing machine is said to be practically noiseless and will not prove annoying in the kitchen of an apartment. The machine shown in the accompanying illustration is of adequate size for the home, hospital, hotel or small laundry, and while durable in



THE JUDD WASHING MACHINE.

construction is sufficiently light to be easily moved about.

Cleveland Loses by Three-Cent Fares.

Four months' operation of the Cleveland Street Railway Company shows a deficit of $79,000 under the three-cent-fare rule. In June alone the company lost $49,000, and the directors had to borrow $250,000 to meet the pressing obligations.

Severe Service Conditions Require Improved Manhole Transformer

There is a growing demand for distributing transformers to be installed in underground vaults, called manhole or subway openings, that furnish access to underground systems of distribution. This demand comes from the larger companies who are operating in the big cities.

As these transformers are installed in subway manholes which are liable to flooding from heavy rains or overflow water, one of the main requirements of service is that the manhole transformers shall be water and air-tight; that is, the joints between the case and cover and where the leads issue from the case must be water and moisture-proof.

WESTINGHOUSE MANHOLE TRANSFORMER.

Any expansion of the oil under a rising temperature, of course, compresses the air in the upper portion of the transformer case and causes a rise in pressure. Under abnormal operating conditions, such as a short circuit, a considerable rise in this pressure may occur, which will make the transformer case liable to serious injury. In order to avoid any danger from such occurrences, a safety or relief valve for any excess pressure should be provided.

The Westinghouse type "S" manhole transformer fulfills the foregoing conditions of service and exactions of design and is rapidly increasing its popularity. The magnetic circuits and coils of this transformer are the same as those of the well-known Westinghouse type "S" transformer, but they are mounted in a case of special design, that adapts them to manhole service.

New Induction-Motor Switch.

The J. Lang Electric Company, 421-429 Lincoln Street, Chicago, Ill., is manufacturing and placing on the market a new induction-motor switch, which, it is anticipated, will meet with instant approval owing to its simplicity in design, low cost and protective features.

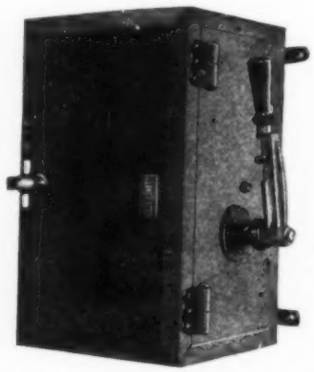


FIG. 1.—INDUCTION-MOTOR SWITCH.

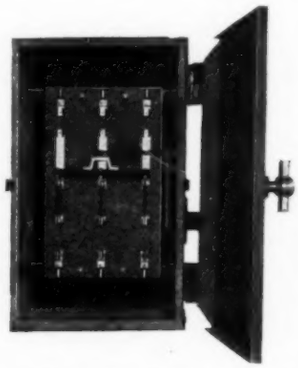


FIG. 2.—SWITCH BOX OPENED.

The switch, which is shown in Figs. 1 and 2, consists of a double-throw knife switch, fused on one end, and actuated by a special handle, exterior to the steel cabinet containing the switch. In starting the motor the handle is moved to the right or unfused side of the switch against the effort of a heavy coiled spring, which prevents the switch remaining in this position if the handle is released. When the motor comes up to speed, a trigger is released, disengaging the handle from the switch, which, by the force of the coiled-spring, is instantly thrown to the left or fused side.

Among the many commendable features of this switch set forth by the manufacturers the following may be mentioned: The starting current, which is several times greater than the running current, does not pass through the fuses, thus permitting the use of fuses small enough to protect the motor and its load when operating regularly. By the peculiar construction of the operating handle it is impossible to throw the switch on the running side without first throwing it on the starting. As the change from starting to running position is made automatically by means of the coiled-spring, the action is quick break and the arcing and burning of contacts cannot occur.

By referring to the accompanying wiring diagrams it will be noted that a variety of starting connections may be used with this switch. Fig. 3 shows the connections for motors of five horsepower and under. As no other starting apparatus is required the double-throw feature of the switch is used simply to carry the starting current around the running fuses.

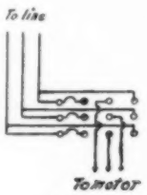


FIG. 3.

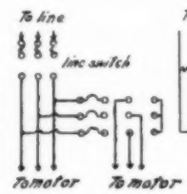


FIG. 4.

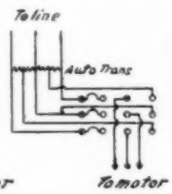


FIG. 5.

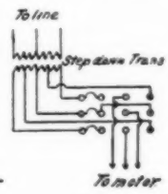


FIG. 6.

Fig. 4 shows the "star-delta" connection, which requires a motor with both ends of the phase windings brought out.

Fig. 5 shows a connection using two auto transformers with voltage taps, producing a reduced voltage for starting. Fig. 6 is similar to Fig. 5, except that the reduced voltage taps are taken from the main step-down transformers supplying the entire installations.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JULY 16.—The High Courts are engaged in hearing an action of great importance to municipalities owning electricity works. In brief, it is a complaint by a large ratepayer in West Haur, near London, that the financial management of the local municipal electricity undertakings during the past four or five years, has been carried on in a manner totally opposed to all laws and sanctions appertaining to municipal government applied to trading departments. By law all money spent upon municipal trading departments has first of all to be authorized by Parliament, and subsequently sanctioned by the Local Government Board. At West Ham, the management of the electricity undertaking has during the past year or two, come under the ban of the Local Government Board, with the result that certain necessary loans for the electricity undertaking have been suspended or withheld. The corporation was thus placed in the position of having to pay its debts, enforcable by the law, on the one hand, and on the other, being refused the necessary authority to raise the money for so paying them. Consequently, it has been driven to the expedient of largely overdrawing its account at the bank, upon which, of course interest has had to be paid. The complaint lodged against it is that such overdrafts are illegal and consequently the interest paid to the bank must be repaid. An injunction is also sought restraining the corporation from continuing such practices, although in the absence of sanction from the Local Government Board, the remedy would not appear to be very obvious. The case is likely to take some time, and at the moment, the only result of the action seems to be to spend the ratepayers' money upon the lawyers to settle a dispute brought about by a Government Department, whose primary functions are generally held to consist of granting loans, the necessity of which is demonstrated. The recent attitude of the Local Government Board in attempting to dictate the laws upon which electricity undertakings should be conducted, is strongly resented by the municipalities.

After having been renewed from year to year since 1904, the scheme for building an electric railway from the city to the northeastern suburbs of London has been abandoned. The announcement was made before Parliament a few days ago, the reason given being that the promoters cannot procure the necessary capital.

The decision of the Chancery Court that municipalities owning electricity works cannot sell fittings or wire premises, without special Parliamentary powers, is to be appealed against. A number of municipal sympathizers are subscribing toward the expense.

It is stated that a number of the National Telephone Company's staff who will not be taken over by the Postoffice, will be absorbed by the International Company which will work the Constantinople telephone concession. G.

MEXICO.

(Special Correspondence.)

MEXICO CITY, MEX., JULY 15—The waters of the rivers and smaller streams of Mexico are being rapidly put to use for generating electric power and irrigating the rich lands of the valleys. Preliminary steps have been taken during the last few months towards the installation of many hydroelectric plants in different parts of the republic. In many instances power and irrigation projects are combined. A number of applications of concessions of this character are now pending in the national department of fomento.

Albert B. Fall is seeking a government concession to use 14,000 gallons of water per second from the Aros River in the Guerrero district, Chihuahua, to generate electricity for use in mines. The plans for the proposed hydroelectric plant have been drawn and its installation will be started as soon as the concession is formally granted.

D. J. Spillane has asked for a concession from the government to use the water from the falls of the Gallinas River in the Santa Maria del Rio district, state of San Luis Potosi, to operate a hydroelectric plant which he is preparing to install there. The power will be transmitted to mining and industrial centers of that region.

The La Cruz Mining and Milling Company has applied for a concession to use 314 gallons of water per second from the Navosaigame River, state of Chihuahua, to generate electrical energy. The power will be used to operate the machinery of the mines and mill of the company.

The annual report of the Compania de Tranvias de Mexico, S. A., which has just been made public shows that the net revenues for the year, after paying all expenses and fixed charges, were $922,457, which is an increase of $462,808 over the pevious year. The sum of $2,066,278 gold was spent during the year in the construction of extensions of the lines of the system and for betterments.

The Monterey Railway, Light and Power Company, of Monterey, has nearly finished the merging of its railway power plant with that of the old electric light and power plant. Nearly all of the machinery installed is new.

The formal inauguration of the new interurban electric railway of the Mexico Tramways company between this city and the town of Xochimilco a few days ago was made the occasion of a great celebration in which President Porfirio Diaz took the leading part. The new line is about seven miles long, including that portion of the system in this city which it traverses. The opening of the line for regular passenger and freight service was witnessed by a large delegation of high public officials of the country, headed by President Diaz. D.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

TO DEVELOP MINES BY ELECTRICITY.—A company composed of Richmond and New York capitalists, headed by S. Dabney Crenshaw, of Richmond, has been formed, which proposes to erect a gigantic electric power plant in Chesterfield County, Va., at or near the mouth of the old Midlothian mines, which have been out of commission for more than a year. The mines are among the oldest in the United States, and are still rich in coal of good steam quality. Power will be transmitted to Richmond, Petersburg and Norfolk. The charter papers were filed a short time ago. The company intends installing a 10,000 horsepower generator, and applications will be made for franchises at the cities mentioned, and probably at other points later on.

ST. LOUIS-KANSAS CITY ELECTRIC LINE.—D. C. Nevins, president of the St. Louis-Kansas City Electric Railroad Company, who is abroad, cables that he has placed $15,000,000 of the bonds of the company, and that the money for building the road will be available as soon as the bonds are reprinted, signed and delivered to the investors in Europe. The directors have approved the action of the president. Secretary H. E. Insley, of the company, says that the sale insures the building of the electric railway between Kansas City and St. Louis in a comparatively short time. The road is incorporated with a capital of $15,000,000. The engineering corps has established seventy-five per cent of the route, by way of Blue Springs, Oak Grove, Odessa, Higginsville, Marshall, Arrowrock, New Franklin and Columbia. It is proposed to run trains hourly with stops at all small stations. Four express trains daily will stop only at the larger stations. Those trains will carry dining and sleeping cars. The road will carry mail, express and freight, the freight trains to be operated principally at night. The company has 10,000 acres of coal lands in Boone, Howard and Lafayette Counties. The power plant will be built near these fields so that electric power may be generated at the minimum cost.

LIGHTING AND POWER.

(Special Correspondence.)

DE SOTO, MO.—This city will install a light system in connection with its waterworks. P.

LESLIE, ARK.—The Leslie Light, Water and Power Company is about to expend $20,000 on improvements to its plant. P.

SUPERIOR, NEB.—The Superior Electric Light and Power Company will remodel its plant and reconstruct its lines.

PRINCETON, IND.—The Princeton Light and Power Company has filed notice of increase in capital stock from $75,000 to $100,000.

VAN HORNE, IA.—The Van Horne Electric Light and Power Company has been incorporated with a capital stock of $10,000. P.

SAVANNAH, MO.—The Savannah Electric Light and Power Company of this city has been incorporated with a capital stock of $15,000. P.

ASHLAND, ORE.—Bonds to the amount of $25,000 have been voted here for the completion of the electric light and power plant, which was started last year. A.

CLIFTON, WIS.—The Clifton Light and Power Company has been incorporated with a capital of $75,000. The incorporators are B. W. Utman, James M. Utman and W. H. Barker.

GROVELAND, CAL.—Manager Graham, of the Gold Ship

Mines, is installing an electric power plant here and will, next month erect a mill for crushing the cement-gravel. A.

TERLINGUA, TEX.—The Chisos Mining Company is installing an electric power plant at its quicksilver mine in this district. The plant will also provide a lighting system for the camp. D.

SAFFORD, ARIZ.—The Pacific Gas and Electric company of Los Angeles, Cal., has been investigating the situation there with the view of installing an electric light and power plant. D.

SAN FRANCISCO, CAL.—The Central California Power Company has been incorporated by S. D. Woods, C. J. Kuchel, R. W. Dennis, W. F. Postel and L. B. Doe, with a present capital stock of $50,000. A.

CAPE MAY, N. J.—The Borough Council has passed an ordinance giving a contract for lighting the streets to the Cape May Light and Power Company. The streets have heretofore been lighted with gas.

ELLENSBURG, WASH.—The Cle Elum Falls Power Company has appropriated 5,000 cubic inches of water of the Cle Elum River. The power developed is to be sold to the cities and private parties for electric light. A.

DALEVILLE, IND.—A company composed of Daleville business men has been formed for the purpose of installing a small electric light and power plant. It is expected that work on the new plant will begin soon.

ROCHESTER, N. Y.—A permit has been granted for the construction of a power plant for the Mechanics' Institute. The structure, which is to be one story in height and 44 feet by 90 feet in dimensions, is to cost $13,000.

SANTA ANA, CAL.—The unincorporated town of Garden Grove has petitioned the Supervisors to call a special election to vote upon establishing an electric lighting system. This is the first time such a petition has come up in this county. A.

VANCOUVER, B. C.—The Vancouver Power Company plans this year to develop the waterpower in the Chilliwack Valley, sixty-five miles east of here. The cost, not including the purchase of the land, is $9,345,000. It is declared that the work will be completed in two years. A.

NEVADA CITY, CAL.—The Middle Yuba Hydroelectric Company has received a car-load of transformers for the new plant on the Middle Yuba River. It is expected that the new power line from Pike City to Alleghany will be completed within the next few weeks. A.

MUNCIE, IND.—The American Sheet Steel and Tin-Plate Company announces that the local factory will be remodeled and enlarged and a large amount of new machinery and electrical equipment put in place therein. The capacity of the plant will be greatly increased. S.

BEATRICE, NEB.—The plant of the Beatrice Electric Company has been sold to E. A. Bullock, who also owns the plants at Norfolk, Blair and two other neighboring towns. This sale was incorrectly reported in our last issue. Mr. Bullock, who is the head of the Bullock Public Service Company, will operate the properties from the Omaha office.

CALMAR, IA.—At a special election a franchise was granted to C. Miller & Sons, of Clermont, Ia., to bring electric power for lighting and other purposes to this town from their power dam. Poles will be erected and the line running from Clermont to Castalia, Ossia and Calmar is expected to be completed before Christmas.

INDIANAPOLIS, IND.—An ordinance has been introduced in the city council requiring the railroads to pay all the costs of maintaining electric lights at all points where the streets are crossed by railroad tracks. There are twenty-one steam and twelve traction lines entering Indianapolis, and the requirement will involve a large expenditure. S.

EMPORIA, KAN.—Prof. B. T. Eyer, head of the electrical engineering department of the Kansas State Agricultural College, recently came here to appraise the electric-light plant. Emporia is considering the advisability of selling its plant to a corporation that offers to put in a street car system if it can secure the city light plant and get a franchise.

NEW ALBANY, IND.—Edward H. Hartley and Louisville capitalists are organizing a company to manufacture gas and electricity for commercial purposes. They propose to furnish lights at $50 a year and sell gas at eighty cents a thousand feet—a reduction of twenty percent from the present rates. The company will make fifteen per cent reduction in the present electric light rates. S.

FT. WAYNE, IND.—The expert brought here by the Ft. Wayne & Wabash Valley Traction Company to investigate the books of the Ft. Wayne municipal lighting plant relative to the cost of commercial lighting at the rates charged reports that the city plant is furnishing current for commercial lights and power at a figure considerably below cost; the exact figures to be furnished soon. The traction company formerly controlled the commercial business and is displeased because the city entered the field at a ruinous low rate.

ERIE, PA.—The Erie Light and Power Company will apply to Gov. Stuart on Monday, August 1, for charter rights and incorporation that will entitle them to manufacture and supply gas and supply light, heat and power by electricity, gas and other sources. Those who are named in the application are T. Sherman Clark, Edward G. Germer, Hugh Neely Fleming, Frank M. Wallace and Harry L. Moore.

SPOKANE, WASH.—J. L. Harper, representing the North Washington Company, has closed a ten-year lease for the Similkameen power plant near Oroville, Wash. This company, which also owns and operates an electric light and power plant at Republic, Wash., will increase the capacity of the new plant and will extend its transmission lines throughout Okanogan County where there is a demand for power for irrigation purposes. A.

CHATTANOOGA, TENN.—A charter has been granted for the incorporation of the Eastern Tennessee Power Company, of Polk County, with a capital stock of $1,750,000. The company has secured rights of way from Chattanooga to near Parksville, on the Ocoee River, where a large water power plant will be erected. Electricity for manufacturing purposes, and an interurban railway will develop Polk, Bradley, Hamilton and James counties.

MICHIGAN CITY, IND.—The Chicago, Lake Shore and South Bend Electric Railway Company announces that it will furnish electricity at a low rate for light, heat and power at any and all points along its line including adjacent farmers. In order to carry out said purpose the company will expend $40,000 for additional equipment in the company's $1,000,000 power plant in Michigan City. Wire will soon be purchased for stringing a special circuit in accordance with this plan. S.

LOS ANGELES, CAL.—The San Joaquin Light and Power Company has purchased the holdings of the Power Transit and Light Company of Bakersfield. These holdings will be used as a market for the power that is being developed through the building of the Crane Valley dam on the north fork of the San Joaquin River. A high-tension line will be built from the vicinity of Portersville to Bakersville, a distance of seventy miles. W. G. Kerckhoff is the president of the San Joaquin Light and Power Company, and L. M. Farnham, secretary. A.

REDKEY, IND.—The Redkey Electric Company has filed articles of incorporation with the secretary of state. The capital stock is placed at $10,000. The object and purpose of this corporation is to carry on the general business of the manufacture, transmission, distribution and sale of electric current to towns and cities, and the public in general for heating, lighting and power purposes and for the construction and installation of a plant for that purpose. The principal office will be located in Muncie, Indiana. Directors are R. E. Breed, H. L. Finley and Frank B. Ball. S.

CRAWFORDSVILLE, IND.—The city council has awarded contracts for the electrical equipment, complete, for the new $85,000 municipal light plant to be erected in a short time. The contract for the building will be let in August. Bonds will be issued by the trustees in charge of the plant for a portion of the cost; the balance will be taken from the electric light sinking fund. With the building of the new plant the city proposes to furnish electricity in larger quantities and at a less rate than ever before as an inducement for factories to locate in Crawfordsville. S.

BUFFALO, N. Y.—Plans for the permanent illumination of Genesee Street from Washington to Jefferson Streets, have been submitted by the Genesee Street Business Men's Association of this city. It has been proposed to raise $1,500 to defray the expense of installing Tungsten burners and a resolution to that effect has been adopted. These plans which were accepted provide for the removal of the arc lights and the substitution at intervals of from 150 to 200 feet of seventy Tungsten burners. The lights and cost of installation will be met by the association according to their tentative plans and the city will pay for their maintenance.

COVINA JUNCTION, CAL.—The old power house of the Pacific Electric Company has been wrecked and will be succeeded by a new plant, which is to be completed by August 1. The building is of reinforced concrete and exclusive of the 21,000 kilowatt generators, will cost $35,000. Power will be furnished for seven high-tension lines and six will carry power for use on all Pacific Electric lines north of Anderson and Aliso Street. The stations that will be supplied from the new power house include the Pasadena station at the Raymond, Arcadia, Azusa and on the Mt. Lowe division at Altadena and Echo Mountain. The Covina line will get its power at Ramona and Vineland.

GRAND FORKS, N. D.—The Red River Power Company of Grand Forks, N. D., has announced substantial reduction in gas and electric rates and made mention of the fact that improvements aggregating upwards of $100,000 will be made this season. The Red River Power Company is the new name of the Grand Forks Gas and Electric Company which was purchased recently by H. M. Byllesby & Company of Chicago. The principal improvements outlined include the installation of a 750-kilowatt engine-generator unit, the construction of from twenty to twenty-five miles of electric pole line distributing system through the residence district, the construction of nearly four miles of new four-inch gas mains, and special inducements to obtain additional consumers of gas and electricity. In the past there has been practically no electric service for residences in Grand Forks.

ELECTRIC RAILWAYS.

(Special Correspondence.)

WATERTOWN S. D.—The Forest City & Mason City Railroad has been incorporated with the object of building an electric line through this city. P.

ATLANTIC, IOWA.—C. B. Judd states that work on the construction of the interurban line to Villsca, forty miles long, is about to be commenced. C.

CORONA, CAL.—By January 1, 1911, the Pacific Electric Railway Company expects to complete a twelve-mile extension toward Riverside. Work will commence next month. A.

LOS ANGELES, CAL.—At the cost of $100,000, the Pacific Electric Railway Company will build a cut-off line between Rose Hill and Lincoln Park, a distance of two and one-half miles. A.

SANTA MONICA, CAL.—E. C. Johnson has been appointed chief engineer in charge of the maintenance of way and construction of roadway and buildings for the Los Angeles-Pacific Railway Company. A.

EL PASO, TEX.—The El Paso Electric Railway Company has been granted a franchise to construct tracks along Gladstone and Mundy avenues. Construction work is expected to begin within two months. A.

VALLEJO, CAL.—William T. O'Donnell, an attorney of this city, is preparing legal steps to have the proposed electric road of the Valley Traction Company to White Sulphur Springs, declared null and void. A.

LOS ANGELES, CAL.—Work on the proposed Purcell right-of-way has begun. The road is to run from San Diego to Escondido. The contract provides that the work must be completed within two years. A.

COLUMBIA, S. C.—The Charleston Consolidated Railroad, Gas and Electric Company has been given the right to increase its capital stock from $1,500,000 to $2,000,000, by the issue of $500,000 in preferred stock.

MEMPHIS, TENN.—Having completed preliminary surveys for a traction road between this city and Jackson, the Tennessee Traction Company will apply soon for a charter, with a capitalization of $1,000,000. W. K. Burton of Memphis, is president.

MINNEAPOLIS, MINN.—L. N. Loomis, president of the Twin City & Lake Superior line, states that the road will be completed within eighteen months, to the head of the Lakes. The road will be a third-rail electric line and power will come from the St. Louis River. C.

SPRINGFIELD, MASS.—The Western Massachusetts Railway Company is making additions to its power plant in Emery Street, which will double the capacity of the plant. A new boiler, generator, condenser and engine will be installed at a cost of several thousand dollars.

MADISON, IND.—The proposition to construct an electric line between this city and Scottsburg has been revived. The Southern Indiana Traction Company, which proposes to construct the road, is now negotiating for a site in Madison on which to build and equip a power plant. S.

WHITE SALMON, WASH.—Surveying for the Mount Adams electric line has commenced and two crews of seven men each have started work near Snowden and will push through to Camas Prairie. This clinches the promises of the local company that the road would surely be built.

SAN FRANCISCO, CAL.—The San Francisco Electric Railways, of which Lewis F. Byington is president, has filed an instrument which leases to the United Railroads, for a period of twenty-one years, the rights, franchises and property, including 100 cars,—of the Parkside line. A.

DYER, IND.—The work of constructing an electric road from Chicago Heights to Monticello by the Northwestern Indiana Traction Company is progressing rapidly. The grade between Chicago Heights and Dyer is almost completed and work will soon begin between Reynolds and Monticello.

GREENVILLE, TEX.—The proposition to grant S. A. Price of Dayton, Ohio, and associates a fifty-year franchise to construct and operate an electric street railway system here was carried in the election held here. The promoters of the project are preparing to begin the construction work at an early date. D.

SACRAMENTO, CAL.—The Sacramento Electric, Gas and Railway Company has about completed the work of laying its wires underground in the down-town district. This is the result of an ordinance passed several months ago requiring all companies owning poles and wires to put them underground. A.

LAFAYETTE, IND.—C. D. Emmons, general manager of the Ft. Wayne & Wabash Valley Traction Company, has notified the city authorities that he is conferring with the officials of the Terre Haute, Indianapolis & Eastern Traction Company with a view of building a modern terminal station in this city. S.

TOLEDO, OHIO.—A party of interested officials recently inspected the entire line of the Toledo & Western, under the guidance of President John F. Collins. Included in the party were, A. E. Lang, president; L. E. Beilstein, manager, and H. F. Swift, secretary and auditor of the Toledo Railways and Light Company, and W. F. McNutt, manager of the Toledo Beach Resort Company.

HOSTOTIPAQUILLO (JALISCO), MEX.—The Cinco Mines Company, which owns the rich Cinco mines in this district, has under consideration the matter of constructing an electric railway from its property to the railroad shipping point at Magdalena. The proposed road will run through the mountains and will afford a transportation outlet for other mines and industries of the district. D.

PORTLAND, IND.—The Ball Brothers of Muncie, who are financially interested in the Muncie & Portland traction line, have determined on the construction of an extension of the road from this city to Celina, Ohio. The citizens will be asked to supply the right-of-way, and when this is secured the extension will be built at once, thereby establishing connection with the Western Ohio traction system. S.

TEMPLE, TEXAS.—The bondholders who purchased the property of the Belton and Temple Traction Company at receiver's sale have taken over the company's electric street railway system here. The new owners have plans to make extensive improvements and to extend the line into several new residence parts of the city. The interurban line of the company runs between Temple and Belton. W. G. Haag was the receiver for the company.

FT. WAYNE, IND.—President J. Levering Jones of the Ft. Wayne & Wabash Valley Traction Company has notified the city authorities that his company is ready to proceed with the erection of extensive and modern terminals, car barns, shops, etc. in Ft. Wayne, if the city will abandon commercial lighting from its municipal electric plant. Mr. Jones says that he has shown by investigation that the city is furnishing current for commercial lighting below cost. S.

PORTLAND, IND.—The Bluffton, Geneva & Celina Traction Company has decided to adopt the New Corydon route on which to build an extension of its line from Geneva to Celina. Capitalists who have agreed to furnish the money recently went over the two routes and advised in favor of the New Corydon route because twelve bridges will be required against twenty-eight by the other route. The citizens of New Corydon have subscribed $25,000 stock on condition the New Corydon route is used on the road. S.

GREENVILLE, ILL.—Articles of incorporation for the St. Louis and Eastern Traction Company have been filed here. The purpose of the company is to build an electric-traction railroad from Granite City, through Collinsville, Troy, St. Jacob and Highland, through or near Pierron and Pochantas to Greenville. The power house at Collinsville already is controlled by the interests represented in the road. The incorporators are A. W. Crawford, Hillsboro; C. E. Hoiles, Greenville; C. C. Terry, Girard; and J. J. Frey, Hillsboro.

DECATUR, IND.—The voters of Washington township, Adams County, at a recent election, defeated a subsidy tax of $15,000 in aid of the construction of an extension of the Ft. Wayne and Springfield interurban line from the present terminal to Monroe, a distance of six miles. While the officials have made no statement, it is generally believed that the extension will be built with the aid asked for. When this extension is built the citizens of Berne have volunteered to furnish the money to build a second extension to that city. S.

ROMNEY, W. VA.—Ira V. Cowgill and R. P. Monroe have applied to the county court of Hampshire County, West Virginia, for a fifty-year franchise for an electric railway, giving right-of-way over the county road and Northwestern turnpike from the South Branch railway depot at Romney, W. Va., by way of Augusta, Pleasant Dale, Hanging Rock, and Capony Bridge, Hampshire County, to the Virginia and West Virginia state boundary line. The object of the franchise is to construct and operate a trolley line between Romney, W. Va., and Winchester, Va.

PORT ARTHUR, TEX.—The board of county commissioners of Jefferson County will consider the two applications that are pending for franchises to construct interurban electric lines between Port Arthur and Beaumont at its August term. One of these applications was submitted by H. J. Meyers, president of the Port Arthur Traction Company, and the other by I. D. Polk, of Beaumont, who represents a syndicate of capitalists. It is considered improbable that both lines will be constructed, even should the franchise be granted. The distance between the two towns is approximately twenty-five miles. D.

NEW ALBANY, IND.—The proposition to build an electric railroad between Louisville, New Albany, Paoli, West Baden and French Lick, has been taken up by the Board of Trade of Louisville and the leading business men of the cities named. The prospects for the construction of the line in the near future are better than ever before. Those interested in company with competent engineers went over the line and are greatly impressed with the possibilities of the road. There is no railroad within eight or ten miles on either side of the proposed line and the line will penetrate the fruit belt of southern Indiana. The plans of the new promoters will be made public soon. S.

TELEPHONE AND TELEGRAPH.

(Special Correspondence)

ASH GROVE, MO.—The Ash Grove Telephone Company has been incorporated with a capital stock of $15,000. P.

CARMEN, OKLA.—The Eagle Chief Telephone Company has been incorporated with a capital stock of $1,000. P.

HELENA, ARK.—The Lakeview Telephone Company has been incorporated with a capital stock of $1,000. P.

HOLDREDGE, NEBR.—W. C. May has purchased the Holdredge Telephone Exchange from Boorman & Dunlap. P.

VIVIAN, S. D.—The Vivian-Fort Pierce Telephone Company has been incorporated with a capital stock of $5,000.

PLEASANTON, TEX.—The Bexar-Atascosa Telephone Company has been organized with a capital stock of $3,000. P.

BRISTOW, NEB.—The Boyd County Mutual Telephone Company has been incorporated with a capital stock of $100,000. P.

CROSSPLAINS, S. D.—The Star & Crossplains Telephone Company has been incorporated with a capital stock of $5,000. P.

LYONSDALE, KAN.—The Lyonsdale Farmers Mutual Telephone Company has been incorporated with a capital stock of $10,000. P.

NICHOLS, GA.—The Nichols Telephone Company is in the market for wire and complete outfit. Address W. R. Frier, of Douglas, Ga.

CARMEN, OKLA.—The Eagle Chief Telephone Company has been incorporated with a capital of $1,000. The directors are R. M. Johnson and S. Terrel of Carmen and A. T. Whitworth of Augusta.

ATALLA, ALA.—Farmers' telephone lines are to be established out of Atalla to Sand Valley and Steele, respectively. Another is projected to Whortor's Bend. All are to be connected with the Southern Bell Telephone and Telegraph Company.

TACOMA, WASH.—Telephone communication has been established between Paradise Valley and Ashford and Longmire Springs. This makes it possible for parties climbing Mount Tacoma to talk to the city without going to Ashford or Longmire, as was formerly necessary.

WINNEMUCCA, NEV.—The Golconda Telephone and Power Company has completed arrangements to extend its telephone line from Lovelock to this city. Work on the new lines will be commenced as soon as the material can be got on the ground, with the expectation that both lines will be in operation during the early fall months.

ELDERON, WIS.—Incorporation papers of the Elderon Telephone Company have been filed. The company will operate a telephone system in the counties of Marathon, Waupaca, Portage and Shawano. The capital stock is $10,000. The incorporators are A. J. Plowman of Eldernon, and F. E. Bump and H. H. Manson of Wausau.

PITTSBORO, IND.—The Home Telephone Company of Pittsboro has filed articles of incorporation with the secretary of state. The corporation has a capital stock of $2,000. The company proposes to build, equip and operate a telephone system in Pittsboro and Parke County. Directors: J. D. Gentry, J. F. Levnard, W. E. Breaman, W. M. Dillon and Chas. O. Suber. S.

OXFORD, IND.—The Oxford Telephone Company, capitalized at $25,000, has filed articles of incorporation with the secretary of state. The purpose of the company is to own, construct, equip and operate a telephone system in Oxford and throughout Benton County. Joseph W. McConnell, Oxford, Ind., William J. McConnell, William D. McConnell and others are directors. S.

LAS ANIMAS, COLO.—The Colorado Telephone Company will make $24,000 worth of improvements on the plants at Las Animas, Lamar and Holly this summer and plans are being laid for the improvement of other of their offices and plants in the Arkansas Valley. A new cable plant will be installed at Las Animas which will cost $8,000, and $16,000 will be spent at Lamar and Holly. This work will be started soon. It was found necessary to make these improvements on account of the increase in business.

HALIFAX, NOVA SCOTIA.—Consul-General James W. Ragsdale reports that the Maritime Telegraph and Telephone Company of Nova Scotia, which was incorporated during the last session of the legislature, proposes to extend its telegraph service not only to the large towns, but to the villages and rural communities which heretofore have had no telegraph service. The company controls some patents by which it can send telegrams over telephone wires without interfering with the telephone service, thus making the wires do double duty.

TOLEDO, OHIO.—The new automatic plant of the Toledo Home Telephone Company in West Toledo, is rapidly nearing completion, and it is expected will be in operation by August 1. The new plant will take care of about 700 phones. By installing the automatic switching station about 500 main lines will be taken off the central board at the down town office. The congestion will thus be relieved and room made for more subscribers. The company now has about 15,000 subscribers while the capacity of the present board is but 12,000. Instead of 500 or 600 main lines coming into the central office, about fifty or seventy-five trunk lines will connect the people in the new district with those in other parts of the city. H.

SPOKANE, WASH.—The Interstate Telephone Company, Limited, of Spokane, and the Interstate Consolidated Telephone Company, of Butte, Mont., have been merged to do business between points in eastern Montana and the Pacific Coast. The last named becomes the holding corporation for a number of companies, the property value of which is placed at $2,000,000. Thaddeus S. Lane, president of the Butte Company, announces that traffic agreements have been made with the Home Telephone Company, of Spokane. The exchange of the Interstate will be moved to the Home Telephone Company's exchange, and all the instruments will be changed to automatics. The new officers of the Interstate Telephone Company elected on June 16 are: Thaddeus S. Lane, president; M. A. Phelps, vice-president; Adolph Galland, treasurer, and John F. Davies, secretary. The merger means a rush of development work in telephone circles in Spokane immediately, as connections by through wires can be made east to Billings, Mont., north to Great Falls, Mont., and south to Salt Lake, Utah.

Electrical Securities.

The week, although business was light and stocks fell, had a number of favorable developments. Labor troubles on the Pennsylvania system were dispelled quickly and with no cost to the company. Railroad reports show increased earnings, even on those roads where the new and higher scale of wages is in effect, with every promise of a big business throughout the balance of the year. There is nothing in the market situation to alarm the investor. At present levels the list is one of bargains and attractive yields.

DIVIDENDS.

Connecticut Railway and Lighting Company; regular quarterly dividends of one per cent on both common and preferred stock, payable August 15.

Guanajuato Power and Electric; preferred quarterly dividend of one and one-half per cent, and an extra dividend of eight-tenths of one per cent, both payable August 1.

Kellogg Switchboard and Supply Company; quarterly dividend of three per cent, payable August 2.

National Carbon Company; preferred quarterly dividend of one and three-quarters per cent, payable August 15.

North Shore Electric; quarterly dividend of one per cent, payable August 1.

Ohio Traction; preferred quarterly dividend of one and one-quarter per cent, payable August 1.

West Penn Railway Company; regular quarterly dividend of one and one-quarter per cent on the preferred stock, payable August 1 to stock of record July 22.

Western Telephone and Telegraph Company; regular semi-annual dividend of $2.50 per share on the preferred stock, payable August 1 to stock of record July 21.

NEW YORK.

	July 25.	July 18.
Allis-Chalmers common	8½	8½
Allis-Chalmers preferred	28	27½
Amalgamated Copper	59⅜	58⅝
American Tel. & Cable	*80	*80
American Tel. & Tel.	131¾	132¼
Brooklyn Rapid Transit	73⅝	77⅝
General Electric	139	142
Interborough-Metropolitan common	16⅞	17½
Interborough-Metropolitan preferred	48⅛	50¾
Kings County Electric	124	124
Mackay Companies (Postal Telegraph and Cables) common	87½	84
Mackay Companies (Postal Telegraph and Cables) preferred	73½	73
Manhattan Elevated	128½	126
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
U. S. Steel common	65⅝	70¼
U. S. Steel preferred	114⅛	116⅜
Western Union	60	61
Westinghouse common	57½	58⅞
Westinghouse preferred		125

BOSTON.

	July 25.	July 18.
American Tel. & Tel.	131¾	132¼
Edison Elec. Illuminating	255	250
General Electric	139	142
Massachusetts Electric common	14¼	14¾
Massachusetts Electric preferred	78	78
New England Telephone	132	133½
Western Tel. & Tel. common	15	15
Western Tel. & Tel. preferred	85	85

PHILADELPHIA.

	July 25.	July 18.
American Railways	42	42
Electric Company of America	11⅝	11½
Electric Storage Battery common	49	49½
Electric Storage Battery preferred	49	49½
Philadelphia Electric	14⅝	14¾
Philadelphia Rapid Transit	17⅝	10¼
Philadelphia Traction	84½	84⅜
Union Traction	43¼	41⅞

CHICAGO.

	July 25.	July 18.
Chicago Railways, Series 1	65	65..
Chicago Railways, Series 2	15	15½
Chicago Subway	2¼	2
Chicago Telephone	117	117
Commonwealth Edison	116	116
Metropolitan Elevated common	80	80
Metropolitan preferred	61	60
National Carbon common	116	116
National Carbon preferred	118	118

PERSONAL MENTION.

SIR WILLIAM CROOKES has been invested with the Order of Merit by King George of England.

F. E. WOOD, formerly with the General Electric Company, has gone to Ponce, Porto Rico, as assistant engineer of the local Electric Light and Power Company.

WM. H. McKINLOCK, president of the Metropolitan Structural Supply Company, of Chicago, returned last week from a two weeks' rest at Narragansett Pier, R. I.

JOHN B. WHITEHEAD, PH. D., has been made professor of applied electricity in Johns Hopkins University. This is a promotion from his former associate professorship.

D. E. BLACK, newly appointed superintendent of maintenance of motive power and equipment for the Illinois Traction System, has removed his office from Decatur to Springfield, Ill.

CLAUD L. DAWSON, secretary of the Anderson Traction Company, of Anderson, S. C., has resigned his position with the electric company, to go to Puerto Cortez, Honduras, as United States consul.

EDWARD LUCAS, a former newspaper man of South Bend, but originally from Terre Haute, has accepted a position with the Northern Indiana Railway Company. He will have charge of the publicity work in connection with the traffic department.

GEO. A. McKINLOCK, president of the Central Electric Company, of Chicago, was a New York visitor last week, combining electrical and financial business. Mr. McKinlock, in addition to large electrical interests, is an active director of one of the leading banks of Chicago.

FRANK McMASTER, manager of the Beatrice Electric Company, at Beatrice, Neb., will retire at the end of the present month and be succeeded by Mr. Capps, who leaves the plant at Blair. The Beatrice plant will hereafter be operated by the Bullock Public Service Company, which has obtained control.

HARRY CURTIS RICE, vice-president and general manager of the General Incandescent Lamp Company, Cleveland, Ohio, sailed from Montreal, on July 23, on the steamer Megantic, for Liverpool. Mr. Rice will visit Great Britain and the Continent, and will attend the Passion Play at Oberammergau. He is expected to return about the middle of September.

ROBERT J. CHAMBERS, vice-president and general manager of the Montgomery Light and Water Power Company, made an address at a recent meeting of the Business Men's League of Montgomery, Ala., in which he made an earnest plea for the improvement of Montgomery and the necessity of squarely meeting the requirements for the progress and advancement of that city.

L. D. GIBBS has been made superintendent of advertising of the Edison Electric Illuminating Company of Boston, as successor to Converse D. Marsh, who has retired. Mr. Gibbs came originally from St. Johns, Mich., and started work in a printing office at the age of twelve years. He afterward learned shorthand, did considerable clerking, and then settled down in the newspaper business. He later went to college and served some time in Washington in official work and representing various newspapers. Four years ago he joined the soliciting staff of the Boston Edison Company and has since served as secretary-treasurer of the New England Section of the National Electric Light Association. During 1909, Mr. Gibbs was also secretary of the New England Section of the Illuminating Engineering Society.

CHAS. M. NININGER, of Atlanta, Ga., has been appointed manager of the Atlanta exchanges of Southern Bell Telephone and Telegraph Company, with title of district commercial manager, succeeding A. H. Marchant, who has resigned. Mr. Nininger is well known and popular in Atlanta. He is a telephone official of experience and ability, having served the Southern Bell Company for a number of years, holding important positions. Mr. Nininger entered the service of the company in 1905, coming from Baltimore, where he was in the telephone business. In the immediate past, Mr. Nininger was special agent to the superintendent of the first division, which comprises Georgia. He held a similar position in Alabama and was also manager of the Montgomery, Ala., exchange.

OBITUARY.

HARRY W. COX, English manufacturer of coils, interrupters and other X-ray apparatus, died on July 9 as the result of dermatitis contracted from prolonged exposure to the Roentgen rays. Mr. Cox was one of the pioneers in this field, and before the dangers of the work were appreciated, he exposed himself freely to the rays. He suffered from the disease for several years, and finally succumbed.

CHARLES E. WALTERS, superintendent of the Home Telephone Company, was instantly killed by coming in contact with an electric wire while adjusting telephone wires on a pole. An electrical storm had put about 300 telephones out of order, and he had been rushed in an effort to get them into working shape. His neck was broken by the fall from a pole. He was born in Grand Rapids, O., and had been prominent in telephone circles for years. He leaves a widow and one child.

NEW PUBLICATIONS.

PROCEEDINGS OF THE ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—The notes on concrete construction which are included in this publication treat at length on the materials of construction as well as the methods used and the results obtained. A paper by F. R. Babcock, which is published in this number of the Proceedings, treats on the lumber situation in the United States and Canada.

TRAVAUX DU LABORATOIRE CENTRAL DES ELECRICIENS.—The Societe Internationale des Electriciens has issued the first volume of the "Travaux du Laboratoire Central d'Electricite." This covers the research work done at the Paris laboratory from 1884 to 1905, and contains many valuable papers. The majority of the articles represent work done since 1900 and are by no means obsolete, in spite of the lateness of publication. In the list of authors the names of Janet, Laporte, Iliovici, and David are prominent. The papers deal mainly with electric and photometric measurements.

NATIONAL ELECTRIC LIGHT ASSOCIATION BULLETIN.—The July number of this publication contains among other items of interest, an excellent editorial on the work of the association. In answer to the objection that too much was attempted at the recent St. Louis convention the *Bulletin* takes the stand that the diversity of interests demanded this wide field. The Association is growing and new branches of the industry must be attended by the formation of new committees. At present many important branches have no committee. It is, therefore, likely that the scope of the papers will be wider, rather than narrower, at future convention.

NEW INCORPORATIONS.

SAN FRANCISCO, CAL.—The Ideal Electric Company has been incorporated by M. B. J. Gerke, F. L. Gerke and H. F. Sullivan, with a capital stock of $10,000. A.

PITTSTON, PA.—The Jenkins Electric Company of this place has been incorporated with a capital of $5,000 to supply light, heat and power. The directors include R. M. Hughes, J. H. Glennon and K. J. Ross, all of West Pittston.

CHICAGO, ILL.—The Baird Electric Company has been incorporated with a capital of $5,000 to manufacture electric apparatus. The incorporators are: Geo. C. Dent, J. A. Campbell, E. P. Baird, Attorneys, Poppenhusen & McNab, all of Chicago.

DUNKIRK, N. Y.—The Dunkirk Electrical Manufacturing Company with $100,000 capital, has been incorporated, the general office to be here. The directors are A. W. Cummings, H. T. Litchfield, O. B. Mulholland, C. J. Carney and John Lechner.

SPRINGFIELD, ILL.—The Garver Track-Laying Machine Company of Urbana has been incorporated with a capital stock of $50,000 to manufacture and operate track-laying machines and construct railways. The incorporators are Taylor M. Garver, Oliver W. Lamb and Harvey M. Grant. Z.

NEW YORK, N. Y.—The Railway Improvement Company of New York City has been incorporated to do a general contracting and electrical business. The capital stock of the concern is $100,000. The directors are Rufus L. MacDuffie, George Keegan, C. V. Smith and T. J. Kenyon, of New York, and E. W. Fairchild, of Oneonta. T.

AUGUSTA, ME.—The Combination Tail Light and Illuminated Automobile Number Corporation has been organized at Lewiston, for the purpose of manufacturing and dealing in patent automobile tail lights, etc., with $150,000 capital stock, of which nothing is paid in. Officers: President and treasurer, J. Addison Patron of Winthrop, Mass.

NEW YORK, N. Y.—The Rochelle Construction Company, a corncern which will construct railways, railroads and electrical plants to distribute electrical power, has been incorporated. The capital stock is $25,000 and the directors are Chester W. Cuthell, J. Frank McDavitt and Fannie Goldstein, all of New York City. The principal place of business of the firm will be at New Rochelle, N. Y. T.

ALBANY, N. Y.—Articles of incorporation have been filed with the secretary of state by the Moxomite Insulating Company of Albany, N. Y. The company will manufacture all manner of insulating material, electrical coils and electrical machinery and apparatus. The capital stock is $10,000 and the directors are William E. Milbank, Myron D. Shiverick, and Frederick A. Tyler, all of Albany, N. Y.

BLOOMINGTON, IND.—The Brown-Smith Battery Company has filed articles of incorporation with the Secretary of State. The capital stock is $25,000. The object of this association is to carry on a general manufacturing business, including the manufacture and sale of storage batteries, electric-lighting apparatus, motors, dynamos and all material connected with batteries and electrical apparatus of all kinds. Charles L. Rawles, Fletcher Gardner, M. E. Showers, J. E. P. Holland, Philip Hill and L. V. VanBuskirk are directors. S.

PROPOSALS.

POST OFFICE, MARLBORO, MASS.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until August 25, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Marlboro, Mass., in accordance with the drawings and specification, copies of which may be obtained from the custodian of site at Marlboro, Mass., or at the supervising architect's office.

POST OFFICE, BRADFORD, PA.—The office of the Supervising Architect, Washington, D. C., wil receive sealed bids until August 29, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Bradford, Pa., in accordance with drawings and specification, copies of which may be obtained from the custodian of site at Bradford, Pa., or at the supervising architect's office.

NAVY DEPARTMENT SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on vaval supplies on the dates given below. Bidders interested therein should make early application for copies of the schedule, giving the schedule numbers desired. Schedules can be obtained from the Navy Pay Office nearest each navy yard. Bids will be asked on the following supplies:

Date.	Material.	Quantity.	Delivery at	Schedule Number.
Aug. 2. —	Fittings, interior, for mercurial thermostats	242	Norfolk, Va.	2727
	Transformers	9	North Chicago, Ill.	2716
	Transformers, single-phase	3	Charleston, S. C.	2717
	Wire, rubber-covered	44,000 feet	Brooklyn, N. Y.	2717
Aug. 9.—	Auto-starters, multipoint	4	Brooklyn, N. Y.	2744
	Cable, single conductor	8,700 feet	Newport, R. I.	2746
	Cable, twin rubber covered, lead sheathed	2,350 feet	Norfolk, Va.	2744
	Insulators, strain	150	Norfolk, Va.	2744
	Switches, antennae	5	Brooklyn, N. Y.	2759
	Wire, copper, weather-proof	3,500 pounds	Norfolk, Va.	2744
	Wire, galvanized steel	8,000 feet	Norfolk, Va.	2744

INDUSTRIAL ITEMS.

THE SAFETY ELECTRIC COMPANY, Chicago, Ill., moved on July 1 to its new building at No. 15 Michigan Avenue. The company also announces that with a factory equipped with all modern appliances, it will be better prepared in every way to give efficient service.

THE ASHLAND ELECTRIC COMPANY, Chicago, Ill., maker of steel switch-boxes and dealer in general electrical supplies, recently moved from West Division Street to larger and more commodious quarters at 1136 Milwaukee Avenue. The company is now in shape to handle its trade, which is showing a constant increase.

WICKES BROTHERS, Saginaw, Mich., includes in the July issue of its monthly stock list a number of bargains in electrical machinery and instruments. The list also includes a number of boilers, engines, pumps, machine tools, etc. The specialty of the company is complete plants, either for wrecking or as going construction.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., is sending out folders on Sherarduct installations. The folder shows two buildings which have made use of this rust-proof, noncorrosive conduit. One of these buildings is High School building No. 59, in Baltimore, Md., and the other, the American Beet Sugar Company's plant at Oxnard, Cal.

THE H. W. JOHNS-MANVILLE COMPANY, New York, N. Y., is mailing a folder on its "J.-M." dry batteries, calling attention to their serviceability in ignition work for automobile and motor-boat engines. A diagram with an explanation is presented to the reader to show the desirability of using the compound series-multiple connection with this or other batteries.

THE COPPER ROLLER BEARING TROLLEY WHEEL COMPANY, of New York, has certified to the secretary of state that it has changed its place of business from New York city to Coxsackie. The directors of the company are: Edwin H. Merriam, Edwin S. Anthony, Newton A. Calkins, of Coxsackie; Greene B. Raum, Jr., and William F. Weyburn, of New York city. T.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has recently assumed the agency for pumps made by the Epping-Carpenter for an additional generator. This machine will be a 115-kilowatt, 2,300-volt, sixty-cycle, three-phase alternator. The same company will also be finished with four 250-kilovolt-ampere, oil-filled, self-cooled transformers for use in connection with the transmission of power to phosphate mines.

THE MINE AND SMELTER SUPPLY COMPANY, which recently assumed the agency for pumps made by the Epping-Carpenter Company of Pittsburg, and the air compressors made by the Bury Compressor Company of Erie, Pa., has large offices and warehouses at Salt Lake City, U., in addition to those at Denver, El Paso, and Mexico City, as previously announced. The executive offices of the company are at No. 42 Broadway, New York City.

THE GOLDSCHMIDT THERMIT COMPANY, New York, N. Y., publishes in its last number of "Reactions," an account of the salving and repairing of the U. S. S. *Nero*, which was wrecked on the rocks of Brantons Reef, near Newport, R. I. The stern frame of the vessel was welded in three places by the thermit process and the various operations are shown by some excellent illustrations. A number of other interesting articles are included in the publication.

THE STUART-HOWLAND COMPANY, Boston, Mass., has recently issued folders relative to the use of electricity in gasoline automobiles. One of these, entitled, "How to Procure Perfect Ignition and Lighting Service for Your Car," contains a description of the Geiszler non-sulphating storage battery igniter. These igniters are guaranteed for a period of one year. The other folder, "Electric Lighting for Automobiles" shows a diagram, and explains the arrangement of the Stuart-Howland series-multiple system of wiring.

H. T. PAISTE COMPANY, Philadelphia, Pa., has just issued catalogue No. 16, dated July 1. The catalogue is in condensed form and omits a great deal of detailed description on well-known material. The July number of *Paistery*, which was sent at the same time, announces a new arrangement as to publications. *Paistery* will hereafter be issued between the times of appearance of the condensed catalogues. Each new number of the publication will show the new things added to the line since the appearance of the last catalogue, keeping the customer perfectly informed at all times.

THE STANDARD GAUGE RAILWAY AND DOUBLE SAFETY WHEEL SYSTEM has been devised by Levert Clark, of Detroit, Mich., and is described by him in a recent pamphlet. The wheels of the locomotive and cars are double, there being two wheels on either end of each axle. The two wheels on either end are separated by a little more than the width of a rail, and the outer wheel is not flanged. In the event of the flanged wheel jumping the track the train would still be held on the ties by the track. It is possible to use this system with double tracks and double wheels, single tracks and double wheels, or double tracks and single wheels.

THE CUTTER ELECTRICAL AND MANUFACTURING COMPANY, through its Chicago office, recently closed a contract for the circuit breakers for the Chicago & Northwestern Railway Company's terminal power house in Chicago. The equipment, as specified by Pierce Richardson & Neiler, the consulting engineers, is composed of I-T-E motor-operated remote-control circuit breakers and switches for the protection of the engine, turbine and motor driven generators. This apparatus is so constructed that whether being operated electrically from the control board or manually at the breaker, it cannot be held closed against an overload or reversal of current, and is equipped with direct acting inverse time limit (Dalite) devices throughout.

THE J. LANG ELECTRIC COMPANY, 421-429 Lincoln Street, Chicago, Ill., is distributing general Catalog No. 810, devoted to its comprehensive line of electrical distributing apparatus. In addition to the well-known line heretofore listed, this new catalog contains illustrations and descriptions of entirely new apparatus, conspicuous among which may be mentioned the new Lang induction-motor switch and new panel boards. A vast line of knife switches, ground and detector switches, switch parts, fuses, fuse blocks, panels, cabinets and switchboards have also been listed, many changes in construction and prices being evident. The foregoing, in addition to a miscellaneous line of apparatus, together with diagrams and tables, makes the catalog a valuable publication for the electrical industry.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., calls attention in a recent flyer to an instance in which flake graphite was used with success after several other lubricants had been tried. The case was one involving the use of three gun-metal rollers, one weighing 1,386 pounds and each of the others weighing 752 pounds. These rollers are heated by gas to a temperature of about 700 degrees, and it was found that any oil or grease would carbonize and cut the journals in a very short while. In this predicament it was suggested that the builders of this machine write the Joseph Dixon Crucible Company concerning the use of graphite on the rollers. This was done, and with a suitable method of applying the lubricant it was found that about a spoonful of graphite each day gave sufficient lubrication to each of the journals. Very little attention was necessary.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, Ill., announces through G. A. Joy, western sales engineer, that a contract has been closed for a complete exchange equipment for the Cape Girardeau Bell Telephone Company, Cape Girardeau, Mo. The new switchboard and apparatus will be installed in a new building specially fitted for the service, the company having purchased the big stone building on Broadway and Ellis Street, which will be used as the central office and general offices of the organization. The switchboard is to have an ultimate capacity of 3,000 lines, a present equipment of 1,000 common-battery lines; ten toll and thirty rural lines. Three sections will be installed at once. The power plant will include the furnishing of storage-battery system, a mercury arc, arc rectifier, Kellogg four-frequency pole changers, two sets of transformers and a slate power board. The equipment will be Kellogg Standard throughout.

DATES AHEAD.

Michigan Electrical Association. Annual convention., Port Huron, Mich., August 16, 17 and 18.

League of American Municipalities. Annual convention, St. Paul, Minn., August 23-26.

Pacific Coast Electrical Exposition. San Francisco, Cal., August 20 to August 27, 1910.

Pacific Coast Electric Vehicle Association. Next meeting, San Francisco, week of August 22.

International Association of Municipal Electricians. Annual convention, Rochester, N. Y., September 6, 7, 8 and 9.

Old Time Telegraphers' and Historical Association and the Society of the United States Military Telegraph Corps. Twenty-ninth annual reunion, Chicago, Ill., September 8-10.

Pennsylvania Electric Association Convention, Glen Summit Springs, Pa., September 14-16.

New England Section, National Electric Light Association. Fall convention, Pleasant Point, New London, Conn.. September 13 and 14.

Colorado Electric Light, Power and Railway Association. Next convention, Glenwood Springs, Col., September 21, 22 and 23.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Kansas City, Kan., September 27-28.

American Street and Interurban Railway Association. Annual convention, Atlantic City, N. J., October 10-14.

American Society of Municipal Improvements. Annual convention, Erie, Pa., October 11-14.

Railway Signal Association. Annual meeting, Richmond, Va., October 11.

American Electrochemical Society, Eighteenth General Meeting, Chicago, Ill., October 13-15.

American Association of Electric Motor Manufacturers. Semi-annual meeting, Chicago, November 14, 15, 16.

Alabama Light and Traction Association. Next meeting, Anniston, Ala., November 21, 22, 23.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) July 19, 1910.

964,492. OXYGEN-GENERATOR. Monroe S. Clawson, New York, N. Y. Filed July 29, 1909. An apparatus for generating oxygen comprises a retort containing oxidizable material, an ozone generator communicating with the retort, a storage tank communicating with the retort, an ozone indicator located between the retort and storage tank, means to raise the temperature of the retort to release the oxygen from the material therein, and a temperature indicator attached to the retort.

964,493. BRACKET FOR COMBINATION ELECTRIC AND GAS FIXTURES. James D. Coder, Elizabeth, N. J. Filed May 5, 1910. A lighting device comprises a bracket, a rod vertically arranged in the bracket, means for securing the rod adjustably in the bracket and permitting the rod's rotation, a fork mounted to swing vertically on the top of the rod, means for securing the fork to the rod in its adjusted positions, a pipe adapted to slide in the fork, means for securing the pipe in its adjusted positions in the fork, and a lighting fixture on one end of the pipe, the pipe being adapted to conduct, or support the conductor of, the lighting medium.

964,498. ELECTROMAGNETIC PROPELLING SYSTEM. Rexford Dean, Findlay, Ohio. Filed Jan. 28, 1907. In combination with a roadbed provided with rails, are soft iron bars above the roadbed and forming transverse connections at equal intervals between the rails; a vehicle carrying a plurality of electromagnets longitudinally spaced thereon at slightly greater intervals than those existing between the bars; a controller provided with spaced contacts arranged in pairs of series to provide one pair for each magnet and a rotary member for automatically actuating the controller, the rotary member being provided with one electromagnet for each pair of series of the contacts.

964,503. ELECTRICAL MUSICAL INSTRUMENT. Ivan Engstrom, Chicago, Ill. Filed July 14, 1909. A keyboard makes contacts for a system of electric bells.

964,513. INTERCOMMUNICATING TELEPHONE SYSTEM. William W. Hawkins, Cleveland, Ohio. Filed May 9, 1906. The system includes a plurality of telephone stations, a signal device for each station, a series of selective buttons for each station, means for locking any of the buttons in its operated position, and electromagnetic means at each station for releasing the buttons at the station, this means being in parallel or multiple circuit with the signal device for that station, whereby, when the station is signaled, any operated key at that station will be released.

964,519. SHADE HOLDER. Harvey Hubbell, Bridgeport, Conn. Filed Feb. 25, 1910. A shade holder comprises a U-ring having an outer flange to support a shade and a threaded inner flange, an angle ring having a threaded flange adapted to engage the thread of the U-ring and a flange adapted to engage a shade, which is held between said flange and the outer flange of the U-ring, and a threaded contractile collar adapted to engage a lamp socket and to be engaged by the thread of the angle ring.

964,520. SHADE HOLDER. Harvey Hubbell, Bridgeport, Conn. Filed Feb. 25, 1910. A shade holder comprises a U-ring having an outer flange to support a shade and a threaded inner flange, an angle ring adapted to engage the shade on the opposite side and having a flange engaging the U-ring, and a swinging yoke engaging the angle ring and adapted to engage the neck of a lamp socket.

964,521. HOT-WIRE ELECTRICAL MEASURING INSTRUMENT. John T. Irwin, London, England. Filed May 25, 1907. The instrument comprises two strips connected together at one end, two nearly equal resistances respectively connected to the free ends of the two strips or wires, a source of continuous current one pole of which is connected to the united ends of the two strips and the other pole connected to the two nearly equal resistances in parallel, main circuit, a condenser in the main circuit in series with the strips, and means for indicating the difference in expansion of the two strips on the passing of a current from the main circuit through the strips in series.

964,530. TRACK INSTRUMENT FOR SIGNALING SYSTEMS. Thomas MacDougal and James McKinnon Chambers, Boulder, Colo. Filed April 20, 1909. A contact device.

964,536. ELECTRIC SWITCH. William S. McLewee, Yardley, Pa. Filed Feb. 13, 1909. The switch has a sliding-rod and contact-posts, a base having on it a housing made of insulating material and having an aperture formed therein to receive the rod. The housing is located between the contact-posts and is adapted to fill the gap between one of the contact-posts and the rod when the latter is withdrawn from the last mentioned contact-post to break the circuit.

964,569. RAILWAY SIGNALING DEVICE. Philip H. Shue, Denver, Colo. Filed June 9, 1909. The apparatus includes a movable signaling blade, a series of successively arranged disks each having a peripheral groove, into which the next adjoining one projects, means adapted to independently impel each disk when its groove registers with that of the adjoining disk, a transmission means operatively connecting one terminal disk, with the blade, a device normally restraining the opposite terminal disk, an electromagnet adapted to actuate the device so as temporarily to release such disk and means associated with the disks to limit their rotative movement.

964,586. INSULATOR. John Russell Tufts, Jr., Weymouth, Mass., assignor of one-half to F. W. Clark, Boston, Mass. Filed Nov. 29, 1907. An insulator comprises an inner member formed at its inner end to bear on a support, and provided at its outer end with a longitudinal cavity and with an annular coil-clamping jaw, and an outer member formed to slide in the cavity, etc.

964,592. FUSE. Frederick H. Weston, Jr., Schenectady, N. Y., assignor to General Electric Company. Filed April 10, 1902. A thermal cut-out comprises a sinuous strip of fusible metal and a non-conducting absorbent material surrounding the strip.

964,600. INSULATION-CUTTING PLIERS. Harry A. Adams, East Hartford, Conn. Filed March 27, 1909. In combination with plier jaws are opposed cutter sections, each section having side cutting members and an end cutting member integral therewith.

964,612. IMPULSE TRANSMITTER FOR ELECTRIC SIGNALING SYSTEMS. Edward E. Clement, Washington, D. C., assignor to The North Electric Company, Cleveland, Ohio. Filed Nov. 1, 1906. An impulse transmitter comprises a number wheel and a co-operating impulse device, a contact moving with the wheel throughout its impulse transmitting period, and a co-operating adjustable contact separate from the wheel adapted to be set so as to maintain operative circuit conditions for any predetermined number of impulses only.

964,619. ATTACHMENT-PLUG. John C. Dallam, Schenectady, N. Y., assignor to Stanley Electric Manufacturing Company, Pittsfield, Mass. Filed Jan. 11, 1905. A separable electric connector comprises a one-piece base of insulating material provided at one end with recesses, contact clips or jaws located in the recesses, and center and side contacts at the other end of the base electrically connected to the clips or jaws.

964,622. TELEPHONE-RECEIVER. William W. Dean, Elyria, Ohio, assignor to The Dean Electric Company, Elyria, Ohio. Filed March 7, 1910. A metallic receiver shell is made of thin sheet-metal having an open end, the walls of the shell being folded over near the open end to form an abutment. A receiver cap is adapted to be connected to the shell; a receiver support is adapted to be clamped between the abutment and the cap to hold it in position in the shell, and a receiver is secured by the support.

964,630. DYNAMO-ELECTRIC MACHINE. Joseph P. Feeney, Schenectady, N. Y., assignor to General Electric Company. Filed April 6, 1908. A dynamo-electric machine includes a rotatable member, coils therefor having end turns or connections, a support for the end turns, and means for holding each of the end turns in place against centrifugal force comprising a plurality of members arranged in a row, each of the members having one or more flanged portions, each of the flanged portions engaging the exterior surface of a single end turn, and a single stem portion passing between the end turns and secured to the support, the members being spaced apart about the support.

964,646. ADJUSTABLE REFLECTOR FOR ELECTRIC LAMPS. Harvey Hubbell, Bridgeport, Conn. Filed Feb. 25, 1910. A reflector has an opening for the passage of a lamp bulb, a neck having one end bent over into engagement with the edge of the opening, the other end of the neck being provided with a circular rib, and an attaching ring for a lamp socket rotatably mounted on the rib.

964,658. METHOD OF OPERATING ELECTRIC MOTORS. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed May 3, 1904. Renewed Oct. 20, 1908. The method of operating electric motors having armature and field magnet windings, consists in connecting the field magnet windings for each of a plurality of lower speeds so that only a portion of the total current traverses each of the field magnet windings while the total current traverses all of the armature windings, and in next connecting the armature windings so that only a portion of the total current traverses each of them for each of a plurality of higher speeds.

964,659. MEANS FOR OPERATING AND CONTROLLING SINGLE-PHASE ALTERNATING-CURRENT MOTORS. B. G. Lemme, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed May 3, 1904. Renewed May 19, 1909. In combination with a source of alternating current energy and an electric motor having series-connected armature and field-magnet windings, are means for supplying variable voltages to the motor as a whole and for causing the ratio of the ampere turns in the field magnet winding to those in the armature winding to change as the voltage applied to the motor is varied.

964,664. ARC-LAMP. George M. Little, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed May 6, 1907. In combination with a casing having an aperture the walls of which are flared inwardly, are angularly disposed vanes located upon the exterior of the casing and extending across the aperture.

964,665. STARTING DEVICE FOR ELECTRIC LAMPS. George M. Little, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed May 6, 1907. There are means comprising an electromagnet winding, for moving the electrodes into and out of engagement, a switch (for shunting the electromagnet winding) comprising a stationary member and a reciprocatory member actuated by the means for moving the electrodes into and out of engagement (these members engaging during a portion of the movement of the reciprocating member in each direction), means interposed in the path of the reciprocatory switch member for preventing the same from engaging the stationary member until near the limit of its travel in one direction, and for maintaining the members in engagement during the first portion of the travel of the member in the opposite direction, and means for delaying movement of the reciprocatory member in one direction.

964,666. CASING FOR ARC-LAMPS. George M. Little, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed May 6, 1907. A top for the casing comprises two spaced parallel plates of the same diameter the edges of which are joined by vanes, and a chimney tube that projects through and above the lower plate.

964,687. BATTERY AND HOLDER. George Lewis Patterson, New York, N. Y., assignor to Alice C. Patterson, New York, N. Y. Filed May 26, 1908. The holder comprises an insulating head, a holder element comprising two socket members anchored in the head and insulated from each other, a battery cell, and two terminals adapted to the sockets respectively, the sockets and terminals being nonsymmetrical in arrangement to prevent reversal of polarity.

964,691. ARC-LAMP. Richard Fleming and Cromwell A. B. Halvorson, Jr., Lynn, Mass., assignors to General Electric Company. Filed Jan. 16, 1906. The arc lamp includes a movable member, an actuating device, a lever pivoted to the actuating device, and a pair of clutch members mechanically connected to the lever, one at each side of the point of connection of the lever to the actuating device, each of the clutch members engaging the movable member.

964,692. INCANDESCENT ELECTRIC LAMP. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to General Electric Company. Filed Sept. 13, 1907. In combination with a metal filament held under tension between supports are means for preventing free vibration of the filament.

964,710. ELECTRIC SIGNALING SYSTEM. John D. Taylor, Edgewood Park, Pa., assignor to The Union Switch and Signal Company, Swissvale, Pa. Filed April 28, 1908. A block signaling system.

964,711. ELECTROMAGNETICALLY-OPERATED SWITCH. John F. Tritle, Schenectady, N. Y., assignor to General Electric Company. Filed July 1, 1908. Describes the mechanism in detail.

964,714. ALTERNATING-CURRENT MOTOR. Per Utne, New York, N. Y., assignor to The Union Switch and Signal Company, Swissvale, Pa. Filed March 25, 1909. In combination with a rotatable nonmagnetic metal armature are a pair of magnets, each having a plurality of pole-pieces arranged on opposite sides of the armature, and means for polarizing the pole-pieces to have certain of them to co-act to produce a turning torque on the armature in one direction, while the others neutralize each other to produce no turning torque on the armature.

964,722. APPARATUS FOR CASTING MOLTEN MATERIAL. Kirke West, New York, N. Y., assignor to United States Graphotype Company, New York, N. Y. Filed Dec. 28, 1905. A metal founding apparatus includes a duct having a nozzle, a strap surrounding this nozzle, and means for passing a current through a divided circuit including the strap, one branch of which includes the duct.

964,737. INSULATED DISTRIBUTER FOR ELECTRIC SERVICE-WIRES. John B. Ashley, Seattle, Wash. Filed July 14, 1909. An insulating casing entirely surrounds the wire-distributing support; a plurality of divisions are carried by the casing and the support and adapted to receive a plurality of wires; and means engaging the casing surround the support and are adapted to support both the casing and the support.

964,741. CONTACT-FORMER OR LINE-TAPPER. Charles A. Beghtol, Canon City, Colo. Filed July 3, 1908. A contact former or line tapper comprises a threaded shank having a wire receiving passage extending transversely therethrough, and an insulation cutting knife carried by the shank.

964,742. DYNAMO-ELECTRIC MACHINE. Bernard Arthur Behrend, Norwood, Ohio, assignor, by direct and mesne assignments to The Bullock Electric Manufacturing Company and Allis-Chalmers Company. Filed December 23, 1904. In a multicommutator dynamo-electric machine there are positive and negative collecting devices for each commutator, the positive collecting devices for one commutator having a resistance materially greater than the negative collecting devices for the same commutator, and the positive collecting devices for the second commutator having a resistance materially less than the negative collecting devices for the second commutator.

964,743. TIMING SYSTEM. Theodore S. Bindschedler, Detroit, Mich. Filed November 15, 1909. A vibrator for timing the hair springs of clocks and watches, comprises a lever, electrical means for vibrating the lever in unison with a master clock, means for supporting a hair spring and balance wheel below the lever, means supported on the lever for holding and determining the lengths of the springs, and means for marking or timing the springs to indicate the point of pinning the springs to the clock or watch movements.

964,751. MOTOR CONTROL. Eugene R. Carichoff, Schenectady, N. Y., assignor to General Electric Company. Filed April 27, 1908. A resistance-controlling device comprises a resistance, a plurality of separated contact blocks movably suspended one from another and connected to different points on the resistance, and a movable member adapted to short-circuit the resistance step-by-step by engaging and moving the blocks successively.

964,759. ELECTRIC HEATER. Archibald S. Cubitt, Pittsfield, Mass., assignor to General Electric Company. Filed February 16, 1910. An electric heater comprises a plurality of coils supported at their ends and connected to operate in multiple, and an intermediate support common to the coils and electrically connecting the same at equipotential points.

964,760. ELECTRIC-CURRENT INTERRUPTER. Peter B. Cummings, Fremont, Neb. Filed August 28, 1908. A clamp for electric conductors comprises a base, a spring member connected near one end to the base and having a free end normally raised from the base, a plate positioned under the free end of the spring member and arranged to be engaged by a conductor, standards on the plate, and a pivoted member on the

standards operable to engage the spring member and clamp the conductor between the spring member and the plate.

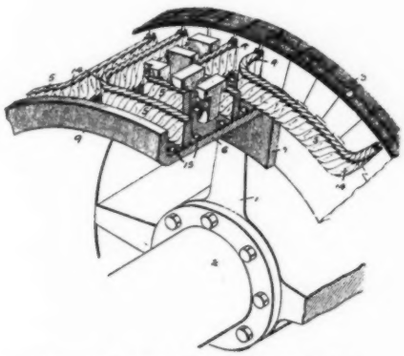
964,770. DYNAMO-ELECTRIC MACHINE. Joseph P. Feeney, Schenectady, N. Y., assignor to General Electric Company. Original application Filed April 6, 1908. Divided and this application filed December 29, 1909. Means for holding the end turns in place against centrifugal force comprise members having portions interlocking with the members mounted on the supporting member.

964,793. METHOD OF OPERATING AND CONTROLLING SINGLE-PHASE ALTERNATING-CURRENT MOTORS. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Original application filed May 3, 1904. Divided and this application filed July 9, 1906. The method of regulating an alternating-current motor having series-connected armature and field magnet windings, consists in adjusting the speed thereof in a plurality of steps or gradations and in causing the ratio of the ampere-turns in the field-magnet winding to the ampere-turns in the armature winding to vary directly as the speed.

964,794. SYSTEM OF CONTROL FOR ELECTRIC MOTORS. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Original application filed May 3, 1904. In combination with a plurality of electric motors having series-connected field magnet and armature windings, are means for adjusting the circuit relations of the field magnet windings to obtain a comparatively small number of field ampere-turns for each of a plurality of lower speeds and a larger number for each of a plurality of higher speeds.

964,798. ELECTRIC SWITCH. Charles F. Lewis, New York, N. Y. Filed May 31, 1906. A sliding-rod switch.

964,819. LOOSE-MOTION DEVICE FOR ELECTRIC CONTROLLERS. Richard Van R. Sill, Newark, N. J., assignor of two-thirds to Alphonzo E. Pelham, New York, N. Y. Filed June 10, 1909. In combination with the rotary shaft having an arm keyed thereon, are means for rotating the shaft, a drum mounted on the shaft having a star wheel equipped with a stud, the drum being capable of rotation independently of the shaft, a spring actuated pawl co-acting with the star wheel, a pair of jaws fulcrumed on the shaft and adapted to receive the arm and the stud between them, and a spring tending to hold the jaws closed.



964,630.—DYNAMO-ELECTRIC MACHINE.

964,830. SYSTEM OF ELECTRICAL DISTRIBUTION. Joseph Lester Woodbridge, Philadelphia, Pa. Filed July 29, 1909. In combination with generating apparatus and a storage battery and its complemental booster and booster regulator operating to relieve the generating apparatus of quick fluctuations of load and to gradually transfer slower fluctuations of load from the battery to the generating apparatus, is an electrolytic valve operatively arranged in respect to the booster for limiting such transfer of load to the generating apparatus.

964,836. AUTOMATIC SWITCH. Charles R. Austin, Longbeach, Cal. Filed April 30, 1907. An automatic switch for telephone or other systems comprises a series of fixed contacts, a movable contact, a carrier for the movable contact, a reciprocating electromagnetic operating means connected to the carrier to cause the movable contact to move progressively by a single movement over the series of fixed contacts, electromagnetically controlled stop means for the carrier, and an operating circuit for the stop means.

964,848. COIN-CONTROLLED MECHANISM. Herbert A. Bullard, Mill Valley, Cal. Filed September 13, 1909. A selective mechanism includes coin-gripping means, a slideway in which the coin-gripping means is movable, stop means to limit the movement of the gripping means in the slideway, and means controlled by the thickness of the coin gripped to control the stop means.

964,863. SEPARABLE ATTACHMENT-PLUG. Harvey Hubbell, Bridgeport, Conn. Filed August 25, 1909. An attachment plug comprises a shell having a longitudinal slot and a spring lying in the slot and attached to the shell below the slot, and having at its upper end an engaging portion adapted to engage the thread of a screw shell to retain the plug in place.

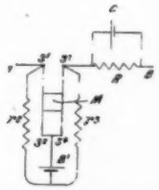
964,891. MOTOR-CAM FOR DOOR-LOCKS. Bror E. Westlin, Arlington, N. J., assignor to Otis Elevator Company, Jersey City, N. J. Filed November 4, 1907. An elevator-door lock-apparatus comprises a motor mounted in fixed position, a motor pulley, a cam, and a flexible connection between the cam and pulley.

964,892. DAMPER-REGULATING MECHANISM. Benjamin C. Wickes, Auburn, N. Y. Filed December 9, 1909. Includes an electric control for the valve mechanism.

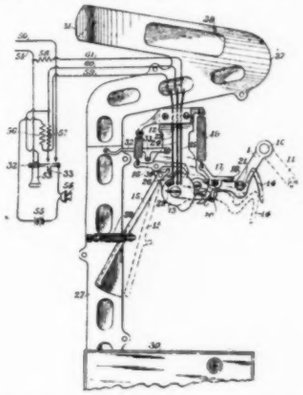
964,953. CURRENT DISTRIBUTING AND COLLECTING MECHANISM FOR ELECTRIC RAILWAYS. Farley G. Clark, New York, N. Y. Filed October 7, 1908. In combination with a car having a transverse way, is a carriage adapted to reciprocate along this way, a turret supported by the carriage and adapted to turn thereon, an arm carried by the turret and adapted to turn thereon, a contact piece, and means connecting the contact piece with the arm, whereby the contact piece is movable horizontally and vertically relatively to the arm.

964,961. CABLE CONSTRUCTION. Henry W. Fisher, Pittsburg, Pa., assignor to Standard Underground Cable Company, Pittsburg, Pa. Filed March 24, 1910. A thermal couple has its members assembled with the cable conductor in the make-up of the cable.

964,969. ELECTRIC-WIRE COUPLING. August H. Hesterhagen, Jersey City, N. J. Filed April 14, 1910. The coupling comprises a base plate of non-conducting material, a metallic coupling plate formed on its back side with a shouldered anchor which is embedded in the base section, and also formed with screw holes for binding screws, a cap of non-conducting material fitting over the base, and securing screw passing through one section and engaging with a nut embedded in the other section.



964,521.—HOT-WIRE ELECTRICAL MEASURING INSTRUMENT.



965,047.—SYSTEM AND APPARATUS FOR MEASURING TELEPHONE SERVICE.

964,994. STORAGE BATTERY INDICATOR. Paul Max Marko, New York, N. Y. Filed December 14, 1909. In combination with a storage-battery cell having positive and negative terminals, are a casing inclosing the same, a voltmeter carried by one wall of the casing, a constant resistance (equaling the normal load on the battery and disposed within the casing) comprising an incandescent lamp and an asbestos sleeve inclosing the lamp, the resistance and the voltmeter being arranged in parallel between the terminals of the cell, and the circuit through each being normally broken, the resistance and the connections thereto being supported and concealed by a filling of insulated material between the cell and the wall of the casing.

965,017. SELECTIVE SIGNALING SYSTEM. Harry O. Rugh, Sandwich, Ill., assignor to Sandwich Electric Company, Sandwich, Ill. Filed February 15, 1909. A telephone system.

965,028. RAILWAY SIGNALING APPARATUS. Philip H. Shue, Denver, Colo. Filed May 17, 1909. A track instrument for completing a circuit through a signaling device comprises two movable elements arranged successively along a railway track to be actuated by a passing train, electrical contacts associated with one of the elements so as to be brought in engagement when the latter is moved in one direction, and means actuated by movement of the second element, whereby

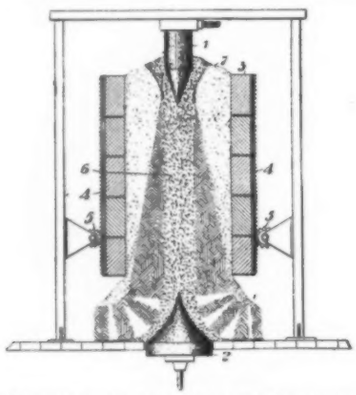
the contacts are separated without affecting the position of the first-named element.

965,047. SYSTEM AND APPARATUS FOR MEASURING TELEPHONE SERVICE. Harold D. Stroud and Charles W. Mahon, Chicago, Ill. Filed February 6, 1905. An automatic substation telephone equipment comprises a transmitter, a calling mechanism, a movable part of which is adapted to be moved successively to obtain a telephone connection of a class for which a charge becomes payable, means in connection with the movable part adapted to render the transmitter inoperative upon the second or subsequent moving of the movable part, and means for rendering the transmitter operative upon the deposit of a coin or token of predetermined characteristics.

965,060. SPACE TELEGRAPHY. Clifford D. Babcock, New York, N. Y., assignor to United Wireless Telegraph Company, New York, N. Y. Filed July 17, 1907. An oscillation producer.

965,062. CHOKE-COIL. Harry J. Beck, Philipsburg, Pa. Filed September 2, 1909. Standards are mounted on a base and provided with sockets with an angular core seated therein; coils are slidably mounted on the core, and a flexible connection between the coils connects the same electrically in series.

965,066. AUTOMATIC ELECTRIC PARCEL-CARRIER. Colquitt H. Bigby, Doddridge, Ark., assignor of one-third to James L. Crane and one-third to Charles A. Miers, Doddridge, Ark. Filed July 16, 1909. The device includes extended tracks, a carrier adapted to the tracks and provided with an electric motor receiving current from the tracks, a suspended basket or receptacle in pendant relation to the carrier, and a cut-out in the motor circuit maintained by the receptacle in closed-circuit position when the carrier is moving on a level



965,142.—METHOD OF MAKING SILICON CARBIDE.

or unhill, and movable by the pendent receptacle to the open-circuit position when the carrier is going down hill.

965,084. MEANS FOR TRANSMITTING POWER. Charles Cleiren, Brussels, Belgium. Filed January 19, 1909. Means for transmitting power comprise a driving shaft, a driven shaft, a motor electric coupling, a clutch for causing the two elements of the coupling to turn at the same speed, one of the elements of the coupling being driven by the driving shaft, and the other element driving the driven shaft, the mechanical connections being so made that the necessary maximum couple on the driven shaft is obtained when the two elements turn at the same speed. An electric generator driven by the driving shaft sends its current into both elements of the coupling.

965,103. ELECTRICAL CONTACT. Gilbert W. Goodridge, Bridgeport, Conn., assignor to The Bryant Electric Company, Bridgeport, Conn. Filed May 11, 1910. The contact comprises cupped members of different diameters, the lesser being inverted and sliding within the greater as a plunger and being offset adjacent its open end, the sides of the other member being slit adjacent its open end to form a plurality of lugs some of which are thrown in to engage the shoulder on the smaller member, in combination with a spring confined between the members and tending to force them apart.

965,123. INSULATOR. Charles Smithson and John W. Osborne, Winchester, Ill.; said Osborne assignor to said Smithson. Filed September 23, 1909. An insulator comprises a hood, a support comprising a flat body adapted to fit within the hood and a central exteriorly threaded stem, strips of insulating material interposed between the hood and the body of the support and means for clamping the body of the support in position.

965,139. STARTING DEVICE FOR ARC-LAMPS. George M. Little, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 3, 1907. In combination with electrodes, and means, comprising an electromagnet winding, for moving the same into and out of engagement, is a switch for governing a shunt to the electromagnet winding; a thermostatic actuating device for the switch has a conductor in series with the electromagnet winding, and an armature carried by the switch is subject to the influence of the winding.

965,142. METHOD OF MAKING SILICON CARBIDE. Frank J. Tone, Niagara Falls, N. Y., assignor to Carborundum Company, Niagara Falls, N. Y. Filed January 7, 1909. The method consists in providing a charge of silicious and carbonaceous material in substantially reacting proportions, around a core of conducting resistance material continuously supplying current to the conducting resistance material, moving the resistance material and charge during the passage of the current, and supplying resistance material and charge material at one point in the movement and removing it at another point in the movement.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired August 1, 1910:

502,272. SYSTEM OF ELECTRIC DISTRIBUTION. Edward M. Bentley, Boston, Mass.

502,273. CARBON-HOLDER FOR ARC LAMPS. Sigmund Bergmann, New York, N. Y.

502,287. ELECTRICAL CASH REGISTER, RECORDER, AND INDICATOR. Leo Ehrlich, St. Louis, Mo.

502,297. ELECTRIC LOCOMOTIVE. Rudolph M. Hunter, Philadelphia, Pa.

502,300. ELECTRIC-POLE CHANGER. Charles E. Kells, Jr., New Orleans, La.

502,315. ELECTRICAL INDICATOR FOR ELEVATORS. Eugene E. Peirce, Boston, Mass.

502,322. ELECTRIC INCANDESCENT LAMP. Paul Scharf, Vienna, Austria-Hungary.

502,325. ELECTRIC JAIL. Charles H. Sparks, St. Louis, Mo.

502,330. FUSIBLE CUT-OUT. Elihu Thomson, Swampscott, Mass.

502,340. RHEOSTAT. James J. Wood, Fort Wayne, Ind.

502,358. ELECTRIC CABLE. Theodore Guilleaume, Cologne, Germany.

502,377. ELECTRIC MOTOR OR DYNAMO. Samuel Paugh, Indianapolis, Ind.

502,381. ELECTRIC SYNCHRONIZER FOR CLOCKS. Henry S. Prentiss, Elizabeth, N. J.

502,384. DYNAMO-ELECTRIC MACHINE OR MOTOR. Harris J. Ryan, Ithaca, N. Y.

502,398. PORTABLE TELEPHONE. Brown S. Flanders, Boston, Mass.

502,399. ELECTRIC TELEMETER. Charles H. Haskins, New York, N. Y.

502,405. GALVANIC BATTERY. Edward H. Lyon, Brooklyn, N. Y.

502,444. ELECTRIC REGULATOR. Daniel M. Moore, New York, N. Y.

502,454. METHOD OF AND APPARATUS FOR MEASURING ELECTRICITY. Aloar Aberg, Helsingfors, Finland.

502,465. MEANS FOR PROTECTING THE CARBON-HOLDERS OF ELECTRIC-ARC LAMPS. Jacob F. Mehren, Chicago, Ill.

502,466. TELEPHONE CIRCUIT AND APPARATUS. James L. McQuarrie, Boston, Mass.

502,471. ELECTRIC ARC LAMP. Charles E. Scribner, Chicago, Ill.

502,472. ELECTRIC ANNUNCIATOR. Theodore Spencer, Cambridge, Mass.

502,487. TRIP FOR RELEASING HORSES. Charles C. Drake, Trenton, N. J.

502,494. ELECTRICAL HEATER. Charles E. Jones, Elgin, Ill.

502,518. AUTOMATIC CUT-OUT. Carl Hoffmann, Berlin, Germany.

502,519. TWO-POLE SWITCH. Carl Hoffmann, Berlin, Germany.

502,530. ELECTRIC-RAILWAY TROLLEY BASE. Otto Rau, Jersey City, N. J.

502.535. CIRCUIT-CONTROLLING MECHANISM FOR ARC LAMPS. Charles E. Scribner, Chicago, Ill.

502,536. ELECTRIC-ARC LAMP. Charles E. Scribner, Chicago, Ill.

502,538. CONVERTER SYSTEM FOR ELECTRIC RAILWAYS. Georg W. Von Siemens, Berlin, Germany.

502,539. ELECTRIC-RAILWAY SYSTEM. Georg W. Siemens, Berlin, Germany.

502,541. ELECTRIC SAFETY-FUSE. Carl Thalacker, Charlottenburg, Germany.

502,624. ELECTRIC WATER-WHEEL REGULATOR. Engene R. Holcomb, Portland, Ore.

502,626. ELECTRIC SIGNAL APPARATUS. Jacob W. Lattig, Easton, Pa.

502,655. SOCKET FOR INCANDESCENT ELECTRIC LAMPS. Waldo C. Bryant, Bridgeport, Conn.

502,660. ELECTRIC SWITCHBOARD SIGNAL. Francis W. Dunbar, New York, N. Y.

502,670. MAGNETO-ELECTRIC MACHINE. Frank X. Hofbauer, Newark, N. J.

502,682. DISTRIBUTION OF ALTERNATING ELECTRIC CURRENTS. Wilhelm von Siemens, Berlin, Germany.

502.687. ARC LAMP FRAME, August Weber, Schenectady, N. Y.